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# REPORT

ON THE

# CLIMATE OF ARIZONA,

WITH PARTICULAR REFERENCE TO QUESTIONS OF

## IRRIGATION AND WATER STORAGE IN THE ARID REGION,

BY

General A. W. GREELY, Chief Signal Officer,
AND
Lieut. W. A. GLASSFORD, Signal Corps.

EXTRACT FROM A LETTER OF THE SECRETARY OF WAR ON IRRIGATION AND WATER STORAGE IN THE ARID REGIONS.

WASHINGTON:
GOVERNMENT PRINTING OFFICE.
1891.

51st Congress, 2d Session. | HOUSE OF REPRESENTATIVES. | Ex. Doc. No. 287.

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# REPORT

ON THE

# CLIMATE OF ARIZONA,

From the

CHIEF OF WEATHER BUREAU,

Washington, D. C.

WITH PARTICULAR REFERENCE TO QUESTIONS OF

## AND WATER STORAGE IN THE ARID REGION,

BY

General A. W. GREELY, Chief Signal Officer,
AND
Lieut. W. A. GLASSFORD, Signal Corps.

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EXTRACT FROM A LETTER OF THE SECRETARY OF WAR ON IRRIGATION AND WATER STORAGE IN THE ARID REGIONS.

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WASHINGTON:
GOVERNMENT PRINTING OFFICE.
1891.

# PREFATORY NOTE.

This report was prepared by the Chief Signal Officer prior to the transfer of the Weather Bureau from the War Department to the Department of Agriculture. In order to satisfy the great interest regarding the subject-matter which it covers, among residents of the region in question, the Secretary of Agriculture has ordered a considerable number of extra copies for distribution among them.

WAR DEPARTMENT,
*Washington City, February* 28, 1891.

The Secretary of War has the honor to transmit to the House of Representatives a report from the Chief Signal Officer, with text, tables, and charts, prepared in response to the resolution of the House of Representatives dated May 23, 1890, that—

> The Secretary of War be, and is hereby, requested to transmit to the House of Representatives the reports that have been prepared under the direction of the Chief Signal Officer of the Army upon the climate of Arizona and New Mexico and other parts of the arid region, together with such tables particularly of rainfall, temperature, evaporation, and other matters as relate thereto, with such corrections, alterations, and additions as may be deemed advisable by the Chief Signal Officer, who will also express his views as to the value and importance of said tables of temperature, precipitation, evaporation, etc., and their bearing upon the subject of irrigation and water storage.

The Chief Signal Officer expresses his opinion that the economic value of these reports is such as to justify their being printed by Congress for the information of the public.

REDFIELD PROCTOR,
*Secretary of War.*

The SPEAKER OF THE HOUSE OF REPRESENTATIVES,
*Washington, D. C.*

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SIGNAL OFFICE, WAR DEPARTMENT,
*Washington City, February* 28, 1891.

SIR: Referring to the resolution of the House of Representatives of May 23, 1890, that "the Secretary of War be, and is hereby, requested to transmit to the House of Representatives the reports that have been prepared under the direction of the Chief Signal Officer of the Army upon the climate of Arizona and New Mexico and other parts of the arid region, together with such tables particularly of rainfall, temperature, evaporation, and other matters as relate thereto, with such corrections, alterations, and additions as may be deemed advisable by the Chief Signal Officer, who will also express his views as to the value and importance of said tables of temperature, precipitation, evaporation, etc., and their bearing upon the subject of irrigation and water storage," I have the honor to transmit herewith text, tables, and charts which illustrate Arizona, California, Colorado, New Mexico, Nevada, and Utah particularly with reference to temperature and rainfall, together with such other notes on the climatic conditions of the region as appear pertinent and important.

Owing to the multiplicity of duties which have lately surrounded the Chief Signal Officer this report has been delayed beyond the time at which he would have chosen to submit it. Even at the present time the Chief Signal Officer has been unable to give it all the personal attention he desired. In view of this fact he delegated to the officer in charge of the records division, First Lieut. W. A. Glassford, Signal Corps, certain portions of the region with which he was acquainted through residence and meteorological examination. Lieutenant Glassford's remarks appear as separate memoirs upon the climate of Arizona, New Mexico, California, and Nevada.

The Chief Signal Officer has treated the subject of the climate of the arid region in perhaps a drier and more practical manner, confining himself to a presentation of such facts and clear deductions as may be of greatest utility to investors and settlers, as well as of theoretical interest to the more exacting student of irrigation problems. The resulting deductions clearly confirm the Chief Signal Officer's theoretical opinion that the arid regions can not be treated as a climatic unit with an entire disregard of physical boundaries, and that no general statement or treatment can be outlined which will be of equal applicability in every State and Territory within the region under discussion.

The Chief Signal Officer expresses his opinion that the climatic data presented herewith are of great value and importance to any corporation or community contemplating investments in works of irrigation or for water storage, and recommends that they be printed for the general information of the public.

Very respectfully,

A. W. GREELY,
*Chief Signal Officer.*

The SECRETARY OF WAR.

# REPORT ON THE CLIMATOLOGY OF THE ARID REGIONS OF THE UNITED STATES, WITH REFERENCE TO IRRIGATION.

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By Gen. A. W. GREELY,
*Chief Signal Officer, U. S. Army.*

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The object of the resolution, in answer to which this report and accompanying charts and tables are submitted, calls for a consideration of this question from a standpoint indicated by the Chief Signal Officer three years since. In a previous report to the Senate (on the "Rainfall of the Pacific Slope," etc., Fiftieth Congress, first session, Senate Executive Document No. 91), in February, 1888, before Congress took legislative action regarding the arid regions of the United States, the Chief Signal Officer pointed out the magnitude of the irrigation question as affecting the future agricultural interests of the population over one-third of the area of the country, and also specifically expressed the opinion that this question could not be satisfactorily discussed and treated without an accurate knowledge of the rainfall over the area of each particular drainage basin.

In treating this subject exhaustively, a large volume could be prepared which would undoubtedly be of great value as a standard work of reference in connection with tentative enterprises for the development of the natural resources of the United States west of the one hundredth meridian, but in a report of this kind to Congress brevity is an essential feature, even if the limited time available for the preparation of the accompanying data did not, as it does, impose it upon the Chief Signal Officer.

In answering the resolution, the attention of the Chief Signal Officer has been directed to the States and Territories of Arizona, California, Colorado, Nevada, New Mexico, and Utah. The States and Territories enumerated comprise in their limits those sections of the United States over which the rainfall is the smallest, the prevailing temperatures the highest, the evaporation of moisture most decided, and the amount of sunlight the greatest; thus presenting, and in some localities combining, such maximum meteorological phases as are of an adverse character to the regular and successful prosecution not only of agricultural enterprises, but, indeed, to the development of any other industry wherewith an abundant supply of water is an essential factor, and for which in these regions the adventitious aid of irrigation is indispensable. The above-mentioned meteorological conditions are less marked and less unfavorable in the remainder of the arid regions, viz, northern California, Wyoming, Montana, the eastern parts of Oregon and Washington, and western portions of Nebraska, Kansas, Indian Territory, Texas, and the Dakotas.

It is a serious error and somewhat prevalent that one can predicate the necessity of irrigation by simply ascertaining and comparing the annual rainfalls of various localities. It needs no elaborate discussion to demonstrate not only the practical inutility of such comparisons, but also the certainty that deductions therefrom must be nearly always misleading and frequently detrimental.

To illustrate this point may be quoted the annual rainfall of Pittsburgh, Pa. (36.71 inches), and that of Julian, San Diego County, Cal. (37.68). As these rainfalls are almost identical in amount, it would naturally be assumed by one not conversant with the peculiar distribution of meteorological conditions of the United States, which conditions depend almost as much on peculiar locality as on latitude, that any industry or pursuit in which rain is an important element would succeed as far as water is concerned equally well at either place. There could be no greater mistake, however, as the following data of average rainfall for Julian, Cal., and Pittsburgh, Pa., clearly indicate.

| | Jan. | Feb. | Mar. | Apr. | May. | June. | July. | Aug. | Sept. | Oct. | Nov. | Dec. | Year. | Length of record. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | *In.* | *In.* | *In.* | *In.* | *In.* | *In.* | *In.* | *In.* | *In.* | *In.* | *In.* | *In.* | *In.* | *Years.* |
| Julian | 4.81 | 8.25 | 9.85 | 5.98 | 0.73 | 0.00 | 0.00 | 0.00 | 0.00 | 0.55 | 2.23 | 5.28 | 37.68 | 6 |
| Pittsburgh | 3.21 | 2.62 | 2.85 | 2.61 | 3.07 | 3.59 | 4.96 | 3.45 | 2.53 | 2.49 | 2.58 | 2.75 | 36.71 | 19 |

The rainfall at Pittsburgh is substantially uniform throughout the entire year; the greatest differences between the separate amounts for any two months being only 6 per cent. of the entire amount for the year. At Julian, however, during seven consecutive months, from the first of May to the last of November, only 9 per cent. of the annual amount falls, while nearly one-half (48 per cent.) of the entire precipitation of the year occurs during the months of February and March.

This leads up to the main point, evident to every farmer, that the most important characteristic of the rainfall, apart from quantity, is its proper distribution throughout the year. Over the greater part of the United States the rainfall of the winter months is not of such direct and vital importance to the agriculturists as are the rains of the late spring and of the early summer. This has been illustrated in a report of the Chief Signal Officer (see Senate Ex. Doc. 115, Fifty-first Congress, first session), wherein he has pointed out that the disadvantages of Nebraska, with a rainfall from one-half to one-third below that of the States of Maryland, New York, Pennsylvania, and the interior of Virginia, are neither as extensive nor as material as might seem evident to one casually considering the effect of the annual rainfall. In this respect the great advantage of Nebraska, and this advantage likewise obtains in parts of Kansas and South Dakota, is in the suitable distribution of rainfall throughout the year, particularly during the months of April, May, June, and July, which may be called, not inappropriately, the critical agricultural months from the standpoint of staple crops grown in Nebraska. Over this State as a whole, the percentage of rainfall in each of these four months closely agrees, that for April being about 11 per cent. of the entire annual rainfall; that for May, 17; for June, 16; and for July, 16 per cent.; in other words, substantially 60 per cent., or three-fifths of the rainfall for the year falls during the four months mentioned, the period when such rainfall is most needed for the growth and development of the staple crops.

Although the distribution of rainfall in certain portions of the Atlantic coast States is nearly uniform for the different months, and although the annual distribution on the Pacific coast is known to be peculiar and marked, yet there has been a popular tendency to ignore these widely varying rainfall characteristics and attribute the same climatic conditions to immense areas with widely differing physical features, and also at greatly varying distances from the ocean, the source of rain. Particularly has misapprehension existed as regards general scarcity of rain and its unequal distribution throughout the year, since the same rainfall conditions have often been attributed to the entire arid regions of the United States, which by general consensus of opinion cover the entire United States west of the one hundredth meridian.

Even among the better informed and casual observers of meteorological conditions, the tendency has been to concur substantially with this popular opinion, excepting so far as it relates to the coast region of northern California, Oregon, and Washington. While the belief of the casual observer as to the scarcity of water west of the one hundredth meridian may be considered true in a general sort of way, yet it is not so in many specific and important cases, for the latest rainfall maps of the United States compiled at the office of the Chief Signal Officer show that there are enormous areas of country in the so-called arid regions where the rainfall exceeds 15 inches (by which isohyetal, or line of equal rainfall, the arid region is, by some, limited), and even very large areas over which the annual precipitation exceeds 20 inches, and in lesser areas 25 inches.

The opinion also obtains among many that the rainfall of the arid regions is typically represented by the California rainfall, with a wet season from November to March, and a practically, if not totally, rainless season for the rest of the year. Such a typical curve may not be inappropriately represented by San Francisco, where the average rainfall is as follows: January, 5.10 inches; February, 3.60; March, 3.26; April, 1.93; May, 0.67; June, 0.15; July, 0.02; August, 0.02; September, 0.16; October, 0.98; November, 2.87; December, 5.32; year, 24.08 inches; length of record, 42 years. The data show that 43 per cent. of the annual precipitation occurs at San Francisco during the months of December and January, while only 2 per cent., or substantially no rain, falls between the 1st of June and the 1st of October.

This peculiar distribution of rainfall, however, is not characteristic of the entire arid region, and it obtains definitely only in California (with slight exceptions) and a portion of Nevada. In Oregon and Washington the autumnal rains begin gradually earlier, as one goes northward, commencing nearly a month earlier in Washington, where, however, they cease somewhat earlier in the spring.

These peculiarities as to the annual distribution of rain being so marked and varying, even on the bordering coast of the Pacific Ocean, strongly evidence the necessity of a most careful examination of the annual precipitation régime for the rest of the arid region, over which the rainfalls, as a rule, are less plentiful and more dependent on exceptional causes, and consequently more liable to extreme and unusual fluctuations.

This examination and comparison the Chief Signal Officer has personally attempted as far as the limited time at his disposal would permit, and the general distribution for different States is shown on Chart No. 1 where the typical rainfall curves are what may be called composite, being made up from selected stations, with long records, in the State or Territory to which the curve applies. The values here given are drawn from stations selected with reference to their geographical position as well as to their agreement with the common rainfall régime, and so may be considered as fairly representative of adjacent regions as well as of their immediate locality.

It will appear clearly from these curves, as is more evident by detailed examination of the original data for separate stations, that the varying periods of *wet** and *dry* or *very wet* and *very dry* months are almost as many in number as the States to which they obtain. These curves also make it apparent that, in order to insure in the arid regions economic and successful crops by irrigation, the growth of only such crops should be attempted or encouraged in different sections as are suited to the character of the local soil, the varying local seasonal temperatures, and which by their seasonal period of germination and development would have the advantage of the rainfall of those months in which the greater part of the general precipitation occurs. The advantage of this plan would be that it thus reduces to the minimum the quantity of water, absolutely essential to the success of the crops, which must be caught, impounded, preserved, and delivered on the ground at a considerable expenditure of labor and material.

The general distribution of rainfall throughout the year over the region west of the one hundredth meridian may briefly be defined as follows:

*January.*—This is a *very wet* month over all of California except the southeastern portion, where it is *wet*. In Oregon and Washington the coast region is *very wet* and the eastern parts of the States *wet*. It is also a *wet* month over Nevada and the greater part of Idaho. It is a *dry* month over western Texas and the western half of the Dakotas. It is *very dry* over the eastern half of the two Dakotas, the eastern parts of Nebraska, and over the greater part of Kansas. Over Montana, Wyoming, Colorado (except the eastern half, where it is *very dry*), New Mexico, and Arizona the amount of precipitation is either about the proportional amount with reference to annual rainfall, or deviates slightly therefrom.

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*NOTE.—The terms "wet" and "dry" with reference to months is something more than relative as used in this report. Here it is defined fully with reference to average rainfall, the same rule being followed as has been employed elsewhere. A *wet* month is one in which 50 per centum more rain falls than the average, and in like manner a *very wet* month is one in which double the usual amount of rain occurs, that is to say, 8.33 per cent. of the annual rainfall is the proportional amount for each month, so that under the definition here given a month with 12.5 of the average yearly rainfall is a *wet* month and one with 16.7 is a *very wet* month. In like manner a *dry* month is one in which the average rainfall does not exceed 4.2 per centum of the annual rainfall, and a *very dry* month is one in which 2.1 per centum, or less, of the annual amount occurs.

*February.*—This month is *wet* over Washington, Oregon, and California (except the southwestern part of the State, where it is *very wet*). It is *dry* over the Dakotas southward to western Texas; elsewhere the rainfall for February shows but slight deviations from its proportional amount with reference to the yearly range.

*March.*—A *wet* month for the western parts of Washington, Oregon, and California. A *dry* month over western Texas, the eastern part of New Mexico, Nebraska, the Dakotas, and Montana.

*April.*—A *dry* month in the southern half of Arizona and New Mexico with tendencies in localities to be *very dry*. A *wet* month in the interior valleys of southern California, over western Colorado and parts of eastern Utah, in South Dakota, and over considerable portions of the Indian Territory and northern Texas.

*May.*—A *dry* month over the western parts of Washington and Oregon, over all California, the western half of New Mexico, and the northern half of Arizona, and a *very dry* month in southern Arizona. A *wet* month over Texas (except in the neighborhood of El Paso) northward to include the Indian Territory, northeastern Colorado, Kansas, Nebraska, North and South Dakota, Wyoming, and the greater part of Montana. However, in northeastern Wyoming, western Nebraska, western Kansas, southeastern Colorado, and the western part of the Indian Territory the month is *very wet*.

*June.*—The month is *very dry* over California, southern Nevada, southern Utah, and Arizona, and is *dry* over western Colorado, northern Utah, central Nevada, and the western parts of Oregon and Washington. It is a *very wet* month over Montana, North and South Dakota, Nebraska, and Kansas. It is *wet* over Indian Territory, northwestern Texas, extreme eastern Colorado, and all of Wyoming except the extreme southwestern part, and over northern Idaho.

*July.*—A *very dry* month over California, Oregon, Washington, Idaho, and a *dry* month over northern Utah. A *very wet* month over the eastern parts of North and South Dakota, southwestern Nebraska, extreme western Kansas, eastern Colorado, western Texas, New Mexico, and the eastern part of Arizona. It is a *dry* month over western Arizona (except in the extreme southwestern part), southern Utah, northern Nebraska, and northern Montana.

*August.*—A *very dry* month over California (where it is practically rainless), Nevada, Oregon (where it is nearly rainless), Washington, and western Idaho. It is *dry* over eastern Idaho and extreme northwestern Montana. It is *very wet* over Arizona, New Mexico, and the mountain region of Colorado and southern Utah. It is *wet* over western Kansas, the panhandle of Texas, western Nebraska, and the eastern parts of North and South Dakota.

*September.*—*Very dry* and nearly rainless in California; *dry* over Nevada, southwestern Utah, Idaho, southern Oregon, and the greater part of Wyoming. It is a *wet* month over all of Texas (except the panhandle and southeastern part) and also in extreme southern Texas, along the coast where the month is *very wet*.

*October.*—The month is *dry* over western Arizona, southern California, southern Nevada, and in portions of the interior of southern Oregon and northern California. Elsewhere about the proportional amount of the annual rainfall occurs.

*November.*—A *wet* month in western parts of Oregon, Washington, and northern California. A *very dry* month over the panhandle of Texas, thence northward through western Kansas and western Nebraska, and the eastern parts of the two Dakotas; but elsewhere from the one hundredth meridian to the crest of the Rocky Mountains it is a *dry* month.

*December.*—A *dry* month over western Texas, western New Mexico, Kansas, eastern Colorado, Nebraska, North and South Dakota, with a tendency to be *very dry* in the extreme eastern portion of New Mexico, extreme southeastern Colorado, and extreme northwestern Kansas. The month is *very wet* over western Arizona, California, the greater part of Nevada, Oregon, and Washington.

It must be clearly understood that these terms, *wet*, *very wet*, *dry*, and *very dry*, refer not to the absolute quantity of rainfall over the regions mentioned, but to the average monthly quantities with reference to the proportional part of the annual rainfall, that is, if equitably distributed, 8.33 per cent. of the year's rain would fall in each month.

Attention is especially called to the fact that a paper of this kind must generally deal with averages, but in connection with the subject of irrigation it is of particular importance to briefly consider the question of excessive rainfalls and also of prolonged periods of drought.

In this connection it seems also important to consider the absolute humidity conditions over the arid region, that is, the actual quantity of aqueous vapor contained in each cubic foot of air at or near the surface of the earth.

On charts Nos. 2 and 3 are shown typical curves with reference to the absolute humidity of the air, which is expressed in the number of grains of water in each cubic foot of air. In preparing these charts it has been necessary to ignore State lines, as the distribution of moisture and damp air depends so very largely not only on the contiguity to the ocean, but also on the direction of the prevailing winds and the character of the intervening country over which the wind must pass from the source of water supply. Consequently these typical curves have been drawn for the Pacific coast region, the interior of California, and for Nevada, Utah, Colorado, New Mexico, and Arizona. The important bearing which the prevalence of moisture or dry air has upon growing vegetation is well known, but further than this it has an equally important bearing upon the methods of irrigation, since the drier the air the greater the quantity of stored or flowing water which will be evaporated thereby. As will be noted by reference to these charts, the greatest quantity of water is not found in the same month over all parts of the arid region.

In addition to the charts, it appears advisable to make some general statements as to the prevalence of moisture or dry air over the regions under consideration. It is impracticable to draw for general conclusions any hard and fast line as to what constitutes *very dry* or *very wet* air, as this question turns on the normal temperatures, which in turn depend materially on the latitude, the elevation, and the locality with reference to great bodies of water.

In general terms, however, it has been decided for present purposes to consider as *very dry* that air which contains during the colder half of the year—from October to March, inclusive—less than 1 grain of aqueous vapor to each cubic foot of air over Montana, Idaho, and the Dakotas, and less than 2 grains of aqueous vapor to each cubic foot of air over Arizona and New Mexico, with intermediate conditions for the intervening country. During the six warmer months of the year—April to September, inclusive—the limiting figures have been placed at 2 grains for the more northerly sections named and 3 grains for the more southerly. Under these limitations it appears that there is no *very dry* air over the arid regions during October, but that over the whole region west of the one hundredth meridian, except in California, Oregon, and Washington, along the coast region of the Pacific Ocean, the air gradually grows drier until January, when there is less than 1 grain of aqueous vapor to a cubic foot of air over the Dakotas, Wyoming, Kansas, Nebraska, and the greater part of Colorado; while less than a grain and a half per cubic foot is then to be found over northwestern Texas, the greater part of New Mexico, northern Arizona, Utah, Nevada, Idaho, and the western parts of Washington and Oregon.

These conditions of extreme dryness in the sections just mentioned remain substantially unchanged during February, but by the end of March the nearly normal conditions of October again prevail. Indeed, the spring months of March and April and the autumn months of September and October show for these regions about the normal conditions of the air as regards moisture, which conditions are, of course, always of greater dryness than in States of the same latitude east of the Mississippi River and along the west Gulf coast. During May and June the air is *very dry* over eastern California, New Mexico, Colorado, Arizona, Utah, and Nevada, over which regions a similar condition obtains during June, July, and August, except for southwestern Arizona, where the air becomes moderately moist. Exceedingly *dry* air during the summer and early autumn, with high mean temperatures of 70° and over, where there is less than 2 grains of water to each cubic foot of air, is found over southwestern Utah and eastern Nevada during June and September, and over central Nevada during July and August. In general it occurs that the air is moderately moist over the Dakotas, Wyoming, western Nebraska, western Kansas, and Colorado from June to August, inclusive, except during unusual meteorological conditions, fortunately rare and local, which occur during periods of deficient summer rainfall and prolonged drought, when the air becomes *exceedingly dry*. During such periods of extremely dry air it occurs, although infrequently, that atmospheric disturbances draw this *very dry* and highly heated air over extensive sections of country lying between the drought-stricken regions and adjacent centers of atmospheric disturbance.

No doubt exists in the mind of the Chief Signal Officer that a general introduction of irrigation and the consequent growth of vegetation over regions to the southwest of Kansas would very largely ameliorate the unfortunate meteorological conditions which at times result in the destruction of crops in Kansas by extremely hot winds. The Chief Signal Officer has elsewhere pointed out that the very hot southerly and southwesterly winds experienced over Kansas and Missouri from September 12 to 15, 1882, were intimately connected with a drought, over southwestern Kansas and eastern Colorado, so prolonged that the surface of the country to the west and south of the wind-stricken districts was thoroughly parched and fiercely heated by the constant unclouded summer sun, whose action was facilitated by a continued absence of rain. It has also been pointed out that the frequency and intensity of similar visitations of very hot, dry winds have materially diminished on the Pacific coast since 1859. For 7 years prior to that year, when the interior valleys of California were substantially uncultivated, the number of hot days averaged 13 yearly; from 1859 to 1871 the average yearly number was reduced to 4. The opinion was expressed and reiterated that the immense quantity of land placed under irrigation in California, and the consequent vast increase in the area of vegetation, was an obvious reason why there should be a diminution in these destructive winds. As the regions from which the hot winds proceed have naturally a small rainfall, any steps for the general protection of adjacent countries must be gradual, and also involve a great outlay of labor and money.

Evaporation is a very important element in connection with irrigation. High temperatures and strong winds favor evaporation greatly, since at high temperatures not only will the air contain more aqueous vapor, but the water passes more quickly into the gaseous state, and the greater the quantity of air, whether "wet," "dry," or "very dry," which passes over the water surface, so much the greater the quantity of water lost by evaporation. If only 20 or 30 inches of water were lost annually evaporation would be a factor of minor importance, but over the arid region the water which would be evaporated if freely exposed would attain a depth ranging from 5 to 9, and possibly in some cases 15 feet annually. Under these circumstances it is essential to consider these phenomena.

The depth of water evaporated over free-water surfaces will be stated later, but it is advisable to call attention to Chart No. 4, which shows the variation in evaporation throughout the year. These curves are composite ones, made up from selected stations, and, therefore, fairly represent evaporation conditions over the States or sections to which they pertain. It is important to note that while evaporation is most rapid during the month of June in Arizona, Colorado, and New Mexico, yet in Utah and the interior valleys of California the greatest amount does not occur until the months of July and August. In Nevada the maximum evaporation takes place in August, while on the coast of California, curiously, it is delayed until the month of October.

As a general rule the climatic conditions of the arid regions are marked by the presence of small amounts of aqueous vapor in the atmosphere, relatively high summer temperatures, and the prevalence of quite strong winds, which three conditions greatly facilitate evaporation. There are but few satisfactory observations of evaporation in the arid regions, and the crudity with which most of these observations have been made is such as to render many of them of doubtful value.

Fortunately, investigations of this subject have been made by Prof. Thomas Russell, of the Signal Service, in which the final values, though obtained by somewhat empirical methods, are dependent in part upon careful observations of evaporometers made by skilled observers of the Signal Corps, and partly dependent, by theoretical connection, upon Signal Service meteorological observations of wind, temperature, and dew point for preceding years.

The figures obtained and the curves drawn by Professor Russell show the amount of possible evaporation from free-water surfaces under favorable conditions, and it is believed that they can be depended upon as fair approximation to the existing physical conditions. In any event these are the only data extant which can be applied to the extensive region under discussion, and so must be taken for what they are worth.

It is deemed proper to again state that these figures and curves do not represent the actual evaporation over the whole surface of the State, but only the possibilities of evaporation. It should be further understood that the actual amount of water taken up by the atmosphere depends upon the opportunity of evaporation, which in turn depends upon the relative amount of water surface, the wetness or dryness of the soil and its constituents, and upon the amount and character of vegetation covering the region under consideration.

It may be questioned by those who have not considered this subject in view of the observed facts, that these possible evaporations are far in excess of the actual amounts which could be absorbed from a water area, say, of 100 square miles, but such would be an erroneous supposition as indicated by facts observed on an enormous scale. The most convincing and striking case is that of the Caspian Sea, with an area of about 180,000 square miles. As this is a closed sea of very large area, it is in fact the largest evaporometer in the world, where the silent but powerful operation of nature's forces in this direction are susceptible of direct observation and measurement. It appears from Woeikof (Climates of the Earth, p. 226) that the actual annual evaporation from the Caspian Sea is equal to 1.09 metres, or 43 inches of water. These figures have been determined from observed heights of the water surface of the Caspian Sea, in connection with the measured inflow of the Volga and other contributing rivers.

The great contrast between evaporation over extended water surfaces within the limits of the United States is illustrated by Professor Gilbert in his valuable and exhaustive monograph on Lake Bonneville, which came to hand just as this report was finished. Professor Gilbert gives the amount of evaporation over the surface of Lake Michigan as equal to a layer of water 22 inches deep, this result being derived from the report of Mr. D. Farrand Henry on the meteorology of the Laurentian lakes and the report of the Chief of Engineers for the year 1868, Washington, 1869, p. 980. Professor Gilbert estimates that 80 inches of water are yearly removed from the Great Salt Lake, an estimate closely agreeing with the evaporation values determined by Prof. Thomas Russell, Signal Service, for this region, since according to his calculation the evaporation at Salt Lake City, near the southeastern shore of Great Salt Lake, amounts annually to 74.4 inches in depth.

Professor Gilbert speaks of this locality as follows:

> * * * As in other desert regions, precipitation here results only from cyclonic disturbance, either broad or local, is extremely irregular, and is often violent. Sooner or later the "cloud-burst" visits every tract, and when it comes the local drainage-way discharges in a few hours more water than is yielded to it by the ordinary precipitation of many years. The deluge scours out a channel which is far too deep and broad for ordinary needs and which centuries may not suffice to efface. The abundance of these trenches, in various stages of obliteration, but all manifestly unsuited to the everyday conditions of the country, has naturally led many to believe that an age of excessive rainfall has but just ceased—an opinion not rarely advanced by travelers in other arid regions. So far as may be judged from the size of the channels draining small catchment basins, the rare, brief, paroxysmal precipitation of the desert is at least equal while it lasts to the rainfall of the fertile plain. * * *

Experiments in Sydney, New South Wales, under the direction of Mr. H. C. Russell, government astronomer, shows that the amount of evaporation from day to day depends very materially upon the conditions of the soil. If it is wet on the surface evaporation proceeds much faster than over water, but as the ground dries the earth evaporates less than the water, and, what is a very important matter when considered with reference to large areas of the arid region of the United States, when the soil becomes dry and is packed hard, surface evaporation substantially ceases, even when the soil is damp enough below to keep vegetation growing.

These experiments in New South Wales show the very important factor which suitable vegetation will exercise in bringing subsoil water to the surface, and thus increasing evaporation during the dry portions of the year. The results of the experiments show that evaporation from grass soil is more regular than from bare soil, and in the course of the year it lost more than dry earth by 14 per cent. and also evaporated 9 per cent. greater than water surfaces.

Reeve's experiments at the London Water Works show evaporation from grass land to be 12 per cent. less than from water. In Sydney, during a year of deficient wind, in 1885, the water evaporated most, but in a wet and windy year the grass evaporated most.

It must be admitted, however, that careful and extended observations will be necessary before the definite relations of different classes of vegetation to evaporation have been determined with that accuracy which the importance of this question to the farmer demands.

In 1888 special observations upon evaporation were made at Lake George, New South Wales—a body of water with about 80 square miles of surface, at an altitude of 2,200 feet and surrounded by high land; the lake itself is shallow, especially at the margin. During 1888 the evaporation amounted to 47.72 inches, which in round numbers was twice the amount of the whole rainfall. In 1889 a valuable set of observations were made by means of a tank at Lake George, while the evaporation of the lake was also determined from day to day. In 1889 the evaporation of the lake was 44.29 inches, which gives an average of 46 inches for the 2 years.

Evaporation observations made from a pan in comparison with those from the Piché evaporometer at Sweetwater Dam, San Diego County, Cal., show that the Piché evaporometer indicates, if anything, less than the true value of evaporation from free water surfaces. This deficiency amounts to about 8 per cent., the Piché evaporometer indicating for the 7 months of the year 29.88 inches, the pan observations 32.33 inches.

In 1889 observations made from water in pans at Albuquerque, N. Mex., under the supervision of the U. S. Geological Survey, showed evaporations as follows, in inches: June, 9.6; July, 9.6; August, 9.3; September, 7.5; October, 4.1; a total in 5 months of 40.1 inches, which would probably amount for the whole year to about 80 inches, the evaporation as calculated by Professor Russell.

The average amount of water which could possibly evaporate yearly, expressed as depth of water in inches, and also in cubic miles of water, is as follows:

| States. | Total amount. | Average depth of possible evaporation. | States. | Total amount. | Average depth of possible evaporation. |
|---|---|---|---|---|---|
| | *Cubic miles.* | *Inches.* | | *Cubic miles.* | *Inches.* |
| California | 170.9 | 67 | New Mexico | 146.2 | 78 |
| Utah | 90.9 | 68 | Arizona | 145.9 | 80 |
| Colorado | 108.6 | 69 | Nevada | 145.8 | 90 |

As is stated above, a layer of water to the depth of 67 inches could evaporate from the entire surface of California during a year of normal temperature, wind, moisture, and sunshine, but the difference in the amounts which could evaporate over different parts of the State are very great, increasing very rapidly inland, being about 37 inches along the immediate coast and rising to about 50 inches in the extreme northwestern part, 84 inches in the northern part, and over 100 inches in the southern part. In the very extreme northeastern part—in the Fort Bidwell region—evaporation, however, barely reaches 50 inches. Over fully one-third of California—the extreme eastern, and particularly the southeastern portions—the possible evaporation could reach, if free water surfaces continued throughout the year, the depth of 7 feet or more.

Over Utah the climatic conditions affecting evaporation are extremely constant in their combined operation, and probably of nine-tenths of the entire area the possible annual evaporation would neither exceed 75 inches nor be less than 70 inches.

Over Colorado the resulting conditions are likewise constant for the State as a whole, the possible evaporation ranging between 65 and 70 inches.

The conditions for evaporation in New Mexico are also very constant in action, and are quite accurately represented by the data from three stations, differing widely in geographical position, elevation, etc.—Fort Stanton with a possible value of 76 inches, Santa Fé, 80 inches, and El Paso, Tex. (separated from southern New Mexico only by the Rio Grande River), 80 inches.

In Arizona the climatic conditions are such as to produce widely varying results, the difference between the extremes being well represented by the annual possible evaporation of 55 to 65 inches at Prescott and Fort Apache, respectively, in the highlands of the Territory. Over the belt of country extending from Fort Grant west and northwest to the Colorado River, and embracing a large portion of the Gila River above the junction of the Salt, also over the Maricopa and Yuma Desert and the lower portion of the valley of the Colorado-Grande, the possible evaporation rises to or exceeds 100 inches yearly.

Nevada, as a whole, is a State over which the phenomena of evaporation obtain to the greatest extent. There is but little, if any, part of Nevada where the possible evaporation does not exceed 80 inches annually, and this increases gradually from the northeastern to the southwestern corner, attaining, over the whole southeastern part of the State, a depth of more than 90 inches, and in some localities over 100 inches, annually.

The extreme dryness of the air would doubtless be relieved by irrigation, and this increase of the absolute humidity in the atmosphere would be considerable, locally in cases where light winds occur or calms prevail, while in cases where steady winds occur the benefit of the increased humidity would naturally be enjoyed by the country to the leeward of the irrigated section.

The relation of the actual amount of aqueous vapor in the air to the average temperature is an important one, and such relation is shown by the composite curves of temperature and aqueous vapor for each State on charts Nos. 2 and 3.

As might be expected, the actual quantity of water in the air increases, as a rule, with increasing temperature, so that the amount present is from two to three times as much during the summer as during the winter months. A careful examination shows, however, that the increase in the quantity of aqueous vapor is not commensurate with the increase in temperature from the coldest to the warmest month, so that, although there is much more water in the air during the summer months than during the winter, yet the dryness of the summer months is very much greater, owing to the average humidity. It would naturally be expected that the greatest amount of water would occur during the month of the highest temperature, but this is not so; for while this is true in some States and localities it is not true in others. For instance, in Nevada, as a rule, the warmest month is July, while the largest amount of water in the air occurs during August, thus making the humidity conditions of August considerably more favorable than those of July. Along the Pacific coast the largest amount of aqueous vapor obtains during August, while the warmest month is that of September. In the interior of California, however, different conditions obtain, the maximum amount of aqueous vapor occurring in July while the highest temperature is during August; that is to say, reverse conditions obtain in the interior valleys of California during July and August to those in the adjacent State of Nevada. In Arizona, Colorado, and New Mexico the greatest amount of aqueous vapor coincides with the highest monthly temperature, and the disparity between the humidity conditions of winter and summer is less marked and trying to vegetation than in California, Nevada, and Utah.

The frequency and average daily amount of precipitation are very important climatic characteristics bearing directly on this question of irrigation. In certain localities the rainfalls are frequent and come in moderate showers; in other places infrequent, with moderate daily rainfalls, while in other places very dissimilar conditions to these obtain, of infrequent rain occurring in heavy showers or very infrequent rainfalls in small amounts. For instance, the average amount of precipitation on each rainy day is 0.25 inch of water at Milwaukee, with 134 rainy days in the year; at Rochester, 0.19 inch daily average, with 171 rainy days; at Pensacola, 0.19 inch, with 124 days in the year; at Poplar River, Montana, 0.12 inch, with 83 days.

The question as to how rain comes—whether slowly and steadily in quiet showers or violently in large amounts—is not only important from the general standpoint of irrigation, but also from the practical question of storage by reservoirs. In Arizona, for instance, from 30 to 40 per cent. of the entire precipitation occurs in heavy showers, where the rainfall is upwards of 0.75 inch during a day, of precipitation, and frequently more than an inch falls in a single shower. At Fort Grant 31 per cent. of the rainfall occurs in heavy showers; at Fort Apache, 29 per cent.; at Fort Thomas, 30 per cent.; at Fort Verde, 38 per cent.; at Prescott, 41 per cent. In New Mexico, at Fort Wingate, 30 per cent. of the rainfall occurs in heavy showers, and at Fort Stanton 24 per cent., while at Santa Fé only 18 per cent. thus occurs. At Salt Lake City 19 per cent. of the precipitation is in heavy rainfalls, while at Winnemucca, Nev., only 5 per cent. thus occurs.

It is also most important to consider at what season of the year the very heavy rainfalls come, and as to whether the water is in such quantities as to render it possible to reserve it by storage for use during the drier portions of the year. It is evident, for instance, that the value of waste water stored for irrigation depends very largely upon the season of the year in which it is caught, since in the arid regions, where evaporation is so extremely rapid and constant, water which is caught and stored immediately after the ripening and harvesting of the important crops must be held for many months, subject to enormous loss in various ways, while, on the other hand, rainfall caught just before or at the beginning of the agricultural year will furnish to the irrigated land a much larger percentage of the water originally stored.

Again, is the storage water to be gathered from gradual rains or from violent thunderstorms and cloud-bursts? In this latter connection extracts from the Monthly Weather Reviews of the Signal Service show what may be expected in the way of violent floods, and the possible damage resulting therefrom. These data may be said to cover only the past eleven years, as the data prior to the year 1879 have never been properly collated or examined.

## *LIST OF EXCESSIVE AND DESTRUCTIVE RAINFALLS OF LATE YEARS IN ARIZONA, CALIFORNIA, COLORADO, NEVADA, NEW MEXICO, AND UTAH.*

### ARIZONA.

*December*, 1879.—At Phœnix on the 29th an unusually heavy rainstorm caused the river to rise 10 feet in 2 days.

*August*, 1881.—Near Wickenburgh, Ariz., a cloud burst, causing the Hassayampa River from being perfectly dry at sunset, August 6, 1881, to be a stream a mile wide at 11 p. m., and from 2 to 15 feet deep; in 13 hours the river was again dry. On the 17th a flood interrupted communication and did much damage in the Salt River Valley near Phœnix.

*August*, 1882.—Serious washouts occurred on the 24th between Casa Grande and Yuma.

*December*, 1883.—The Hassayampa at Wickenburgh, which had been dry for several months, suddenly rose on the 22d beyond the fording stage, remained high over the 23d, and then fell rapidly.

*March*, 1884.—At Florence on the 7th a cloud-burst flooded the streets 4 feet deep. On the 10th several miles of track were washed away east of Yuma. On the 11th the Gila broke through its levees and flooded Yuma.

*June*, 1884.—At Yuma the Colorado was in flood on the 9th and seriously washed the railway west of the town. Yuma itself took no damage because levees had been reconstructed since the Gila flood of March.

*July*, 1884.—The flooded Colorado washed away parts of the railway bridge at Yuma on the 1st and 3d.

*September*, 1885.—A freshet occurred at Pantano on the 9th. The railroad track was covered to a depth of several feet and damaged.

*August*, 1886.—This was a month of floods at Yuma. On the 1st, light rain fell during the greater part of the day. Seventy-five miles west of Yuma the rain was heavy, causing a washout on the railway and delaying trains. On the 15th there was a thunderstorm measuring 1.57 inches, of which 0.80 fell in 20 minutes; the railway was washed out both east and west of Yuma, causing a complete suspension of traffic for several days. On the 27th, heavy rain in the mountains washed out the track east of Yuma and delayed trains.

*July*, 1887.—On the 7th a remarkably heavy rain fell at Nogales, flooding streets, destroying bridges, and washing away railway tracks. During the prevalence of a thunderstorm on the afternoon of the 8th, a cloud-burst occurred on the east fork of the White River in the mountains east of Fort Apache. A volume of water 3 feet deep came down the cañon, which subsided in two hours. On the afternoon of the 13th another heavy rain occurred at Nogales in connection with which there was reported a cloud-burst in the mountains southeast of Sonora. Railway traffic was stopped for nearly a month.

*August*, 1887.—During the month there were numerous freshets in the Santa Cruz and Rillito Rivers.

*September*, 1887.—Heavy freshets came down the Santa Cruz and Rillito on the 9th, destroying several miles of track and some bridges near Pantano. On the 12th, 5 miles of track and three bridges were washed away on the Sonora railroad. Near Dragoon a railway embankment 50 feet high was washed out for a distance of 8 miles.

*October*, 1888.—On the 18th in a violent downpour of rain there were extensive washouts along the railway between Yuma and Texas Hill.

*December*, 1889.—On the 5th the Verde and Salt Rivers rose very rapidly and at Fort McDowell the Verde overflowed its banks. On the 6th the Verde overflowed at Fort Verde.

*February*, 1890.—At Fort Verde the river reached its highest flood mark on the 21st and washed out irrigating ditches. A large area of the Gila Valley was flooded during the latter part of the month and irrigating canals were severely damaged. On the 22d a sudden flood on the Upper Hassayampa destroyed the Walnut Grove reservoir, with great losses of life and property.

*August*, 1890.—The Gila was impassable for 10 days at Eagle Pass and ditches were damaged.

*October*, 1890.—Heavy thunder showers at Yuma on the 4th destroyed bridges and washed out the railroad.

### CALIFORNIA.

*September*, 1877.—On the 12th during a heavy thunderstorm, between Pilot Knob and Cactus, on the Colorado Desert, a waterspout burst, destroying 400 feet of railroad.

*January*, 1878.—Successive gales caused many high records of precipitation to be made during the month. On the 7th there fell 1.83 inches at Santa Cruz, followed by 1.46 inches on the 8th. At Sacramento, 3.91 inches fell on the 15th and 16th; at Red Bluff, 9.12 inches from the 14th to 16th; at Los Angeles, 2.14 inches on the same days. Both at Los Angeles and Red Bluff railroad bridges were washed away and much damage was done throughout the country. At San Buenaventura and Santa Barbara wharves were carried away. On the 22d, 1.34 inches fell at Sacramento in 6 hours, and at Red Bluff 2.98 inches on the 21st and 22d. On the 24th, 1.60 inches was recorded at San Francisco, and at Red Bluff, 1.81 inches. On the 25th, 2.30 inches fell at Santa Cruz and the San Lorenzo River rose 5 feet.

*December*, 1879.—The rainfall recorded for the 20th at Los Angeles was 4.19 inches, which so swelled the mountain streams as to cause severe floods and washouts and interrupt railway communication for 36 hours.

*January*, 1881.—The latter half of this month is crowded with flood records in California. On the 18th the Sacramento River was full of driftwood at Sacramento City; on the 29th the river rose rapidly and measured 12 feet above low-water mark at 1 p. m.; on the 30th it stood at 24.5 feet above; and on the 31st it reached 26 feet above. During the night the levee broke 2 miles below the city and laid all the farms and orchards under water; on the other side, both above and below Washington, the levees broke and flooded all the tule lands. On the 18th the highest water in 12 years was measured at San Jacinto. San Francisco on the 29th was visited with the heaviest rain ever known, causing much damage in the city and suspending all railway and telegraphic communication along the coast. Several miles of track were washed away in Santa Cruz County and the towns of Napa, Watsonville, and Marysville were flooded. On the 30th Camp Capitola was washed out to sea by a sudden rise in Soquel Creek, and but four houses of the town were left standing; at Windsor, in Sonoma County, 13 inches of rain fell in 70 hours; at Placerville, 7.61 inches fell in 24 hours, and eight men were buried alive in a slide of the railway bank. At Red Bluff on the 31st the Sacramento reached the height of 24 feet above low-water mark, and all low-lands were flooded, tracks were washed away and railroad cuts filled by landslides.

*February*, 1881.—The Sacramento River on the 4th reached the highest mark ever recorded, 26.5 feet above low water, and the town of Washington was flooded to a depth of 6 feet.

*February*, 1884.—At San Buenaventura 9.60 inches of rain fell during a single storm, which produced a freshet in the Santa Clara River which destroyed bridges and caused landslides. The Santa Ana River in Los Angeles County was so much swollen that its water reached the sea for the first time in 8 years. On the 17th a dam burst on the Los Angeles River destroying 40 buildings and doing other damage. From Los Angeles to Mojave in one direction, and to San Gorgonio in the other, the railway was seriously impaired. On the 21st the town of Fall Brook in San Diego County was washed away.

*March*, 1884.—During the first week of the month heavy rains did considerable damage in southern California, washing away the railway bridge at Colton. This disaster was followed on the 10th of the month by a washout of 6 miles of track west of Daggett.

*April*, 1884.—Heavy rains on the 9th and 10th caused washouts at Newhall, Keene, and Mojave. On the 18th the breaking of one of the San Joaquin levees flooded Lathrop.

*December*, 1884.—The first rains of the winter caused floods in several parts of the State. At Chico a levee gave way on Butte Creek. At Linden the San Joaquin flooded the town 3 or 4 feet deep. In Calaveras and Tuolumne Counties the mountain streams were so flooded as to cause suspension of travel. In Merced the lands were flooded for miles.

*November*, 1885.—In the latter part of the month occurred heavy rains in the southern portion of the State. The San Fernando tunnel caved in, the bridge at El Cajon was carried away, and in general railroad property suffered serious damage. At San Luis Obispo the rainfall measured 10.04 inches for the single storm, and great damage was done to the bridges.

*January*, 1886.—On the 25th the levee at Fresno, which retained the overflow water of the arroyos, burst and flooded three-fourths of the town. The heavy rain of the 18th and 19th swelled the Los Angeles River so that it overflowed its banks and submerged a vast area of the city and county; every railway bridge on the river was damaged, tracks were washed out in several places, four lives were lost and hundreds were made homeless. The money loss was estimated at half a million dollars.

*April*, 1886.—On the 11th 1.97 inches of rain fell at Los Angeles, doing such damage to the railway as far as Fernando as to delay trains.

*January*, 1888.—The heavy rains of the 3d and 4th, 3.39 inches falling in 24 hours, caused numerous washouts on the railroads near Los Angeles, suspending communication.

*October*, 1888.—From the Los Angeles Daily Herald of October 20: "A cloud-burst of extraordinary violence is reported on the desert along the line of the Southern Pacific Railroad. The rain came down in a perfect torrent, on the night of the 18th, causing numerous though not very large washouts between Cactus and Salton, Cal. The water fell in almost a solid mass at times, over 2 inches being registered at one place inside of an hour."

*March*, 1889.—Heavy rains caused washouts on the railroads in southern California, and traffic was generally suspended on the 16th. The Los Angeles River ran bank high, damaging the levee and the bridges and flooding parts of the city.

*August*, 1889.—The heaviest thunder, wind, and rain storm ever known upon the desert visited Daggett on the 17th; cellars were flooded and several houses blown down.

*October*, 1889.—On the 12th a rainfall of 7.58 inches was measured at Encinitas between 10 in the evening and 6 the next morning, which caused considerable damage; the storage reservoir at Cottonwood Creek broke and a large body of water rushed down the valley and washed away the railroad bridge. On the 20th 3.16 inches of rain fell at Los Angeles in 8½ hours and stopped the cable roads. On the 23d 1.87 inches fell and numerous washouts occurred on the railroads centering in that city; the Santa Monica line of the Southern Pacific suffering the severest damage from a cloud-burst in the Santa Monica Mountains, which also destroyed a considerable portion of the Los Angeles and Pacific Railroad.

*December*, 1889.—At Los Angeles the heavy rains previous to the 15th caused considerable damage to the railroads, and the train service of the Southern Pacific and Santa Fé systems was interrupted by washouts. The bridges on the California Southern Railroad between Santa Ana and Los Angeles were washed away on the 23d. At Los Angeles the heavy rains from the 22d to the 26th caused considerable damage; streets were badly washed and the railroad bridges were generally destroyed. The Los Angeles River changed its channel south of the city, flooding the country.

*January*, 1890.—On the 25th a portion of Los Angeles was flooded by a rise in the river, and washouts occurred on the railroads. On the 27th a small portion of Fresno was flooded and the canals in that region overflowed, laying large tracts of land under water.

*February*, 1890.—Considerable damage was sustained near Los Angeles by the river again changing its course just south of the city.

### COLORADO.

*May*, 1878.—Heavy rains on the 19th upon the divide at the head of Cherry Creek, 52 miles south of Denver caused a flood which swept away seven bridges, laid the lower part of Denver under water, and damaged the railroads

*July*, 1880.—At Pueblo on the 13th the rains were very heavy and the creeks badly swollen. Immense damage was done in El Paso and surrounding counties; several bridges on the Denver and Rio Grande Railroad were carried away, and half a mile of track was washed out between Manitou and Colorado Springs. On the 23d three railway bridges and considerable track were destroyed at Colorado Springs.

*August*, 1880.—The heavy rain of the 21st caused many washouts on the South Park, the Kansas Pacific, and Denver and Rio Grande Railways.

*July*, 1881.—The remarkable rainfall of 1.10 inches in 20 minutes flooded Denver on the 31st.

*August*, 1881.—On the 8th a cloud-burst occurred at Central City, causing suddenly a stream of water from 4 to 6 feet deep in two streets. The extensive rains prior to the 20th did great damage in the central part of the State; washouts were numerous, and in some cases extended over 5 miles of track.

*June*, 1882.—At Denver, on the 10th, Dry Creek suddenly overflowed and destroyed many houses, and a similar flood was reported from Golden.

*August*, 1882.—At Black Hawk, in Gilpin County, a land-slide caused by heavy rains buried two houses and a large extent of track of the Colorado Central Railway. The Purgatoire River and the Cache la Poudre River overflowed. Serious washouts occurred on the Denver and Rio Grande Railway.

*June*, 1883.—Rapidly melting snow on the mountains caused floods in the South Platte tributaries, and two bridges were destroyed by the Cache la Poudre River at Fort Collins. West of the divide floods in the Grand and Blue Rivers destroyed nearly all the bridges in Summit and Garfield Counties.

*May*, 1884.—A sudden and destructive rise on the 29th in Frenchman Creek, near the Nebraska line, was conjectured to have been caused by a cloud-burst. Eleven men were drowned, and the flood subsided as rapidly as it had risen.

*May*, 1885.—A cloud-burst occurred on the 17th upon Horse Fly Mountain near Montrose. Culverts were destroyed and roads gravely damaged.

*July*, 1885.—The heaviest rain of the season fell at Fort Collins on the 9th, causing a washout on the railroad. On the 26th a cloud-burst on the divide, at the head of Cherry Creek, caused a sudden and disastrous inundation at Denver. During the evening of the 25th a cloud-burst occurred on the mountains above Templeton Gap and caused considerable destruction at Colorado Springs. The flood-waters when passing through the gap were 175 feet wide and 7 feet deep, thus showing a cross-section of about 1,000 square feet.

*July*, 1886.—A thunder storm on the evening of the 20th near West Las Animas swelled all the streams of that region. The overflowing Purgatoire destroyed many bridges, and on the Atchison, Topeka and Santa Fé Railway 15 miles of track were washed away.

*August*, 1886.—On the 1st a very severe rain accompanied with funnel-shaped clouds and hail set in over the valley of Monument Creek near Colorado Springs. A freshet at once began to rage, poured down the narrow valley, and did great damage in the town, while bridges were quite generally destroyed.

*May*, 1887.—Thunder storms on the 26th, 27th, and 28th caused washouts on the Atchison, Topeka and Santa Fe Railway both east and west of Las Animas.

*July*, 1887.—A cloud-burst occurred in Tucker Cañon, near Golden, on the afternoon of the 14th. A slight rain storm succeeded peals of thunder, and suddenly a wave nearly 20 feet high swept down the narrow cañon, which for weeks had been quite dry. Many persons narrowly escaped death and every trail was obliterated.

*July*, 1889.—On the 19th the Purgatoire at Trinidad, in Las Animas County, began to rise very rapidly and in 1 hour had overflowed its banks.

*August*, 1889.—On the evening of the 9th a rain storm visited Florence, and though it lasted but 2 hours was the severest on record. The Arkansas reached a point higher than ever before known; every bridge within 10 miles of the city was washed away. Three hundred yards of the Atchison, Topeka and Santa Fé Railway were washed out, and the Denver and Rio Grande track was in places almost obliterated. The same storm flooded Pueblo, and between that city and Salida the Denver and Rio Grande track was washed out in five places, each of considerable extent.

*August*, 1890.—On the 14th the heaviest hail and rain storm on record at that place visited Colorado Springs. The total amount of rain and melted hail was 3.18 inches, of which from 2.75 inches to 3 inches fell in 30 minutes. The great volume of water did considerable damage to railroad tracks and bridges and traffic was temporarily suspended.

### NEVADA.

*June*, 1882.—On the 11th 500 feet of track west of the railroad station at Winnemucca were washed away by heavy rain.

*June*, 1884.—On the 10th a cloud-burst in the Humboldt Mountains flooded valleys near Rye Patch and badly damaged the Central Pacific track for 30 miles.

*August*, 1884.—A destructive flood occurred at Eureka on the 7th. The water came from Ruby Hill and entered Adam's Hill Cañon. When the stream reached the Williamsburg mine it was 30 feet wide and 7 feet deep. The Titus mine was filled with water and one man drowned.

*December*, 1889.—The Rio Virgen, in the southern part of Lincoln County, rose so high under the unprecedented rainfall, that it overflowed its banks in many places and changed its course, washing away everything in its path. Lake Tahoe is reported as having risen 12 inches.

*August*, 1890.—On the 11th two intensely black thunder clouds appeared at Palmetto over the crests of the surrounding mountains, one approaching from the north and the other from the east. A short distance from Palmetto these clouds seemed to join and rushed with extraordinary swiftness toward the town. The resultant cloud was riven with lightning, and the air became filled with a terrific roar above which the thunder was hardly audible. A column of water poured down, excavating a trench about 500 feet long, and, in places, 7 feet deep and 20 feet in width. Within 10 minutes the entire lower part of the Palmetto Valley was 2 to 3 inches under water, and the cañon leading to Fish Lake Valley was a torrent. The stage road was obliterated for 9 miles, although the rainfall extended but little beyond Palmetto.

The storm of the 7th at the same place was very similar to that of the 11th, except that the rain seemed to come from one cloud only. This cloud appeared to touch the ground and roll down the mountain side, and the rain covered a greater area.

### NEW MEXICO.

*September*, 1880.—The rainfall of the 21st, measuring 2.80 inches, caused a flood at Silver City, which damaged buildings and drowned a boy.

*August*, 1881.—Three floods visited Silver City during the month, on the 7th, the 15th, and the 20th, of which the second did considerable damage.

*October*, 1881.—Great damage was done to the Atchison, Topeka and Santa Fé Railway on the 6th, and all traffic was suspended south of Las Vegas. In the Rio Grande and Galisteo valleys there were numerous heavy washouts, and in many places the road bed was covered with great heaps of sand.

*August*, 1883.—An apparent cloud-burst on the Turkey Mountains, and the flood consequent upon it, interrupted railway travel near Tipton.

*August*, 1884.—The Pecos River reached a high stage during the latter part of the month at Puerto de Luna. Much damage was done to the dams and irrigating ditches.

*April*, 1886.—Heavy rain on the 19th and 20th caused Santa Fé Creek to assume the proportions of a river. Telegraph communication was interrupted, railroad bridges were washed away, and several miles of track destroyed.

*June*, 1886.—High water in the Rio Grande, in the Valverde, completely overflowed the towns of Chamberino, Launcen, and Nombre de Dios, this on the 2d and 3d of the month. Between the 7th and 10th the freshet having moved downstream washed away houses and railway tracks, destroyed bridges, and submerged three towns in the Mesilla Valley.

*September*, 1886.—Between the 11th and 13th, heavy rains fell between Socorro and Albuquerque, washing away several miles of track, a bridge over the Salida was rendered insecure, and several houses were destroyed in Socorro and San Marcial.

*July*, 1887.—Heavy washouts occurred in the southwestern part of the Territory.

*June*, 1888.—A heavy rainfall on the 18th, on the Sierra Blanca, caused a sudden rise in the mountain water course near Fort Stanton.

### UTAH.

*August*, 1876.—On the 31st at Chalk Creek, 5 miles from Coalville, a cloud-burst was reported, and a solid bank of water, between 3 and 4 feet high, came down the stream, destroying dams.

*July*, 1883.—During the afternoon of the 29th a destructive flood occurred in the Kanab Cañon, in the southern part of the Territory. All of the wheat in the upper settlements was washed away, and a number of cattle were drowned. Many wagons and agricultural implements were lost.

*March*, 1884.—At North Fork the Central Pacific trains were delayed for two days previous to the 7th, owing to an overflow of the Humboldt River. The water in Bear River was higher than has been known since 1873. The river rose 7 feet in 24 hours, washing out all the bridges. Two bridges on the Waldo River were also washed away.

*May*, 1884.—The rivers throughout the Territory were much swollen during the month and the lowlands in the southern part of Salt Lake City were flooded. At Ogden several dams were swept away. Numerous washouts occurred on the Union Pacific. The Denver and Rio Grande Railroad was flooded, stopping all trains. The water in Great Salt Lake reached a greater height than has been known for many years. At Nephi, in Juab County, the railroad bridge over the forks of Salt Creek was washed away on the 9th.

*June*, 1884.—The lowlands of Salt Lake City continued flooded during the month. Dispatch of trains was impracticable on the Denver and Rio Grande Railway for 3 weeks.

*August*, 1885.—A cloud-burst occurred on a ridge of mountains about 3¼ miles northwest of Frisco at 9 p. m., on the 22d. The water is reported to have rushed down the sides of the mountain with such force that large bowlders were displaced.

*July*, 1887.—On the evening of the 10th a flood devastated Fillmore and the surrounding country. The greatest damage was done in the mountains east of the place. Three saw-mills and half a herd of sheep were swept away.

*August*, 1889.—The rainfall was reported unusually heavy at Salt Lake City and surrounding districts, causing washouts on the Union Pacific and Utah Central Railroads. A land-slide, caused by a cloud-burst, wrecked a freight train at Weber Cañon.

From the foregoing list it appears that the excessive and damaging rainfalls, according to their order of greatest frequency, occur in the respective States and Territories as follows: California (southern part), Colorado, Arizona, New Mexico, Utah, and Nevada.

These destructive rainfalls in Colorado occurred without exception during the summer season, the 17 cases on record being distributed as follows: July, 6; August, 5; May, 4; June, 2. In Nevada the excessive rains have been confined, with one exception, to the summer months, the records being, August, 3; June, 2; December, 1. Utah is marked by a similar inclination, the 8 cases being distributed as follows: August, 3; July, 2; June, 1; May, 1; while March is the only cold month marked by a heavy rainfall. In New Mexico, of the 12 cases none occurred during a winter month; the distribution was as follows: August, 5; September, 2; June, 2; July, 1; April, 1; October, 1. California, on the contrary, has only 1 case of damaging rainfall during the summer months, that of August, 1889, near Daggett, in the Yuma desert; the 19 other cases were distributed as follows: January, 5; December, 3; February, 3;* October, 3; March, 2; April, 2; November, 1; the tendency being entirely towards heavy rains during the rainy period. The southern part of California only has been here considered, and these cases are connected with the unusual extension of rain conditions to the southern half of the State. Arizona, while sharing the tendency to summer rainfalls to a great extent in common with Colorado, Nevada, Utah, and New Mexico, yet has occasional cases of severe winter rainfalls. Fifteen instances are divided as follows: August, 5; September, 2; October, 2; July, 1; making 10 cases in the late summer and early autumn, against 3 in December and 1 each in February† and March.

It appears, then, from the records that the excessive rainfalls from which, as has been shown elsewhere, is derived about one-third of the whole rainfall of the arid region, occur very largely during the months of July and August, at a period too late, as a rule, for the economical utilization of such rain as storage of water for the staple crops of that season. Occurring, as these heavy rains do, during the late summer or very early autumn, the water can be utilized on a very large scale only for such crops and productions as can be planted, cultivated, and grown during the autumn and winter season; since, as is shown by data already quoted, of the water stored and held over until the following spring, an enormously disproportionate amount of it must have passed into the air by the steady and inevitable process of evaporation.

More than special interest attaches to the variation in the amount of rainfall from year to year. For instance, in Colorado the greatest amount of rainfall in any year ranges, as a rule and according to locality, from 110 to 150 per cent. of the average annual amount, and the minimum yearly rainfall varies from about 30 to 80 per cent. of the normal. In Utah the maximum yearly rainfall, generally, varies from 130 to 180 per cent. of the normal, while the minimum ranges from 35 to 70 per cent. In New Mexico the maximum generally amounts to from 125 to 150 per cent., though occasionally, at such widely-scattered stations as Forts Union and Craig, and Albuquerque, double the amount of yearly rainfall has been known. The minimum in this Territory varies from 40 to 80 per cent. of the average. In Arizona the maximum amounts for any year are generally between 130 and 200 per cent., the greatest departures from the annual average being at Fort Mojave, 240, and Fort Verde, 250 per cent. of the usual amount. The minimum rainfall averages generally from 45 to 75 per cent., but in one notable instance, Maricopa (record of 10 years), the amount in 1882 was only 8 per cent. In Nevada the maximum generally averages from 130 to 190 per cent., but at Fort McDermit the maximum rainfall is 330 per cent. of the yearly normal. The minimum for the State ranges from 40 to 60 per cent., according to locality. In California the maximum varies from 150 to 200 per cent., and in occasional localities in the southern part of the State ranges from 240 to 300 per cent. The minimum yearly amounts vary from 25 to 60 per cent., but at one place in the Mojave desert, at Indio (record of 14 years), in 1886 only 6 per cent. of the normal rainfall occurred. In short, the amount of rainfall which may occur over the arid regions in different years varies enormously. In Colorado, New Mexico, and Utah, the amounts in the years of greatest rainfall may be from two and one-half to three and one-half times as great as in the years of the least rainfall; in Arizona, from three to four times as great; in Nevada, from three to five times as great, and in California from four to six times as great, with even greater variations in particular localities.

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* The late damaging floods of February, 1891, only emphasize the tendency of destructive rains to occur almost entirely in California during the winter season.

† The very violent and damaging rains in southeastern Arizona in February of this year occurred only in that part of Arizona which has a rainfall régime in substantial accord with that of southern California.

The most important information pertinent to the question of irrigation is the annual rainfall for the regions affected. The following table shows the average annual precipitation in Arizona, California, Colorado, Nevada, New Mexico, and Utah:

*Annual rainfall.*

| State. | Elevation. | Area in square miles. | Cubic miles of rainfall. | Average depth of rainfall in inches. |
|---|---|---|---|---|
| Arizona | Sea level to 3,000 feet | 38,670 | 5.3 | 8.63 |
| | 3,000 to 5,000 feet | 27,230 | 6.3 | 14.56 |
| | 5,000 feet and over | 47,120 | 10.7 | 14.30 |
| | Whole State | 113,020 | 22.3 | 12.42 |
| California | Sea level to 2,000 feet | 82,290 | 27.9 | 21.64 |
| | 2,000 to 5,000 feet | 53,530 | 18.2 | 21.66 |
| | 5,000 to 7,000 feet | 17,334 | 7.5 | 27.56 |
| | 7,000 feet and over | 6,246 | 2.7 | 27.75 |
| | Whole State | 159,400 | 56.3 | 22.56 |
| Colorado | 4,000 feet and less | 8,773 | 1.5 | 11.15 |
| | 4,000 to 5,000 feet | 18,031 | 3.2 | 11.78 |
| | 5,000 to 7,000 feet | 31,314 | 6.1 | 12.74 |
| | 7,000 feet and over | 45,885 | 9.2 | 13.12 |
| | Whole State | 104,500 | 20.0 | 12.61 |
| Nevada | Less than 5,000 feet | 39,759 | 5.0 | 7.98 |
| | 5,000 to 7,000 feet | 57,654 | 10.7 | 11.85 |
| | 7,000 feet and over | 14,590 | 2.9 | 12.92 |
| | Whole State | 112,000 | 18.6 | 10.64 |
| New Mexico | 4,000 feet and less | 6,996 | 1.1 | 10.14 |
| | 4,000 to 5,000 feet | 34,407 | 6.1 | 11.59 |
| | 5,000 to 7,000 feet | 57,503 | 12.4 | 14.13 |
| | 7,000 feet and over | 22,300 | 5.6 | 16.34 |
| | Whole State | 121,200 | 25.2 | 13.62 |
| Utah | 5,000 feet and less | 28,615 | 4.0 | 9.00 |
| | 5,000 to 7,000 feet | 35,444 | 6.5 | 11.59 |
| | 7,000 feet and over | 20,441 | 3.2 | 6.97 |
| | Whole State | 84,500 | 13.7 | 10.32 |

These data indicate that irrigation enterprises in these States, for successful prosecution, demand the most careful and scientific study of climatic conditions, particularly of the amount and distribution of rainfall and the possible evaporation. When perfected, the storage reservoirs must be sufficiently extensive to tide over the temporary droughts, and sufficiently provided with waste-weirs to safely discharge extensive and torrential rainfalls; and must be protected by cover or otherwise against extensive evaporation, while the fall of the feeding canals must be such, and the water conducted therein must be sufficient in quantity, as to insure the speedy delivery of the water without great loss by leakage or evaporation.

Further examination of the detailed data will show that while for very large areas the amount of rainfall and its distribution is such as to insure a copious and quite constant precipitation available for purposes of irrigation, yet within 100 or 200 miles of this same area may be others where the rainfall is so irregular in its fall and distribution, and so deficient in its quantity, as to render most doubtful the economic success of irrigation enterprises. Likewise, contiguous to other climatic conditions favorable to irrigation, may be found rapid evaporation, the continued presence of very dry air, and also of quite high summer winds, all unfavorable to irrigation enterprises.

Not only has the average depth of rainfall in inches been calculated for each State, as a supplement to the charts herewith attached, but a similar calculation has been made as to the average depth of rainfall between different altitudes. While these results have a scientific interest in showing clearly the increase of rainfall as a whole with elevation, yet they have a practical result in indicating to the investor the average gross amounts of water (that is, without loss by seepage, evaporation, or otherwise) in each State from which the irrigating supplies must be drawn. It is evident, for instance, that no more water can be available for land above 5,000 feet in Arizona, California, or elsewhere than actually falls above that level.

The amount of rainfall in cubic miles has been calculated for each State, and also between certain altitudes, the excellent map of the Geological Survey having been used for obtaining data whereby to calculate surface areas between different altitudes in the States named. From these combined data we learn, for instance, that in Utah 13.7 cubic miles of rainfall occur in average years; in Nevada, 18.6; in Colorado, 20; in Arizona, 22.3; in New Mexico, 25.2, and in California 56.3 cubic miles. It is not to be supposed, however, that this quantity of water, or even an approximate amount thereof, is available for irrigation in any particular year. A very large amount of water is lost through absorption by the earth, and a very large amount passes into the air by evaporation. Further, as has been pointed out elsewhere, the quantity of rainfall varies largely in different years, so that in Utah, for instance, the rainfall in one year may amount in the gross, to 6 or 7 cubic miles, while in another year it may reach 20 cubic miles. The amounts given, however, have an important practical bearing which will be readily comprehended by those having irrigation enterprises under consideration or in course of construction.

The elements of cloudiness and of sunshine bear both directly and indirectly on irrigation problems, the presence of sunshine being necessary in certain months of the year for the fruition of growing crops, and the presence of cloudiness also being essential, as during its presence evaporation proceeds in a much more modified degree. Chart No. 5 shows the sunshine and cloudiness—the percentage of sunshine being shown directly and the cloudiness being, of course, the complement of the percentage of sunshine. These curves are composite, being derived from observations of cloudiness at selected stations in the States and Territories referred to. It has been assumed—a reasonable assumption, in which no large error can obtain—that the complement of the cloudiness will be the sunshine.

It might naturally be assumed that the curve showing for each month the precipitation would, as rainfall is associated with cloudiness, follow in diametrically opposing phases the curve of prevailing sunshine. How far this is true it may be well to determine.

Taking the Pacific-coast region as a rule, the amount of sunshine bears a very close and direct relation to the absence of rainfall, the dryest months being those of July and August, and during the latter of these two months the maximum amount of possible sunshine occurs, except in lower interior California, where the greatest amount of sunshine comes—fortunately for the raisin districts—in September, which is even less marked by the presence of clouds than the very sunshiny months of July and August. In Arizona and New Mexico, however, where the percentage of precipitation is considerably larger in August than in any other month, it appears that the largest amount of unclouded sky obtains, not in that month, but in the month of July. However, the extremely sunshiny months of June and October are marked in New Mexico and eastern Arizona by a normal amount of monthly rainfall, the precipitation occurring in short, sharp showers. In Nevada the smallest percentage of rainfall occurs during July, during which period the amount of sunshine is somewhat less than for August or September.

Cloudiness is an important element, since the presence of clouds naturally results in screening the earth from excessive action of insolation, or, in other words, in diminishing the heat received by vegetation from the direct rays of the sun. It also, acting as a screen, prevents in part the radiation of heat from the earth into space, and thus materially tends to modify and reduce the diurnal range of temperature, so that growing vegetation is not subject to as great cold as would otherwise obtain during the night, nor, on the other hand, does it receive the full amount of solar heat by day. While the amount absorbed by a fully clouded sky is not accurately known, yet it must be so considerable as to form an important element in agriculture. On the other hand, the absence of clouds facilitates greatly the process of insolation by day and radiation by night, thus increasing the range of temperature to which vegetation must adjust itself daily. While the highest amount of insolation or the full heat of the direct rays of the sun—the amount for each locality necessarily depending on the elevation, latitude, and mean temperature of the growing season for that locality—is absolutely essential to the complete fruition of many crops, yet the maximum amount of possible insolation in the arid region, when occurring during the summer period over very extensive areas of that region, proves destructive to most vegetation which is not watered by irrigating methods.

Representing the total cloudiness by 100 per cent. and absolutely clear sky by 0, it may be considered that those regions are practically cloudless over which the average amount of cloud is 20 per cent. or less, and that an excess of cloudiness obtains when the face of the sky is covered on the average 50 per cent. or more. On this basis it appears, as might be expected from what has been stated before regarding the distribution of rain throughout the year, that the different sections of the arid region had not an identical cloud régime, in other words, that the excess of cloudiness and the periods of complete sunshine do not occur over the whole arid region during the same months. An examination of the entire region west of the one hundredth meridian shows that cloudless days (an average of 20 per cent. or less) do not obtain over any part of this region during January, February, or March. In December the areas of cloudless regions are very limited, including only portions of extreme southeastern California and southwestern Arizona.

In April this area comprises within its limits the southern half of Arizona, the extreme southeastern part of California, and southwestern New Mexico.

During May and June the cloudless area of April is extended gradually to the north and southwest, so that in the latter month (June) the sky is practically cloudless over western New Mexico, Arizona, southwestern Utah, southwestern Nevada, and all of California except the extreme northern part and the immediate coast region of the latter State, say 20 miles inland.

During July, Utah, New Mexico, and Arizona, except a limited portion of the lower valley of the Colorado in the last-named Territory, are entirely removed from the cloudless belt, which now obtains over California, except the immediate coast region and western half of Nevada and southeastern Oregon.

During August this area is not changed, except that it includes the greater part of Idaho, all of northern Nevada, and extreme northwestern Utah. It may be stated that during July, August, and September, the period of nearly constant sunshine reaches its maximum over the interior valleys of California, during which time very large areas of clouds are comparatively rare.

In September the cloudless region includes California, except the immediate coast, southwestern Oregon and Nevada, as in the preceding months, and also extends southeastward so as to include southern Utah and all of Arizona, except the southeastern portion.

In October the only changes are the gradual movement southward and inland from the sea of the limiting lines in California and Nevada.

In November the area is diminished so that cloudless weather occurs only over southeastern California and the southwestern half of Arizona; which region is still further reduced during December and disappears, as before stated, in January.

Of course the climatic conditions of Colorado, Utah, northern Nevada, and the northern parts of Arizona and New Mexico are such as to preclude extensive and successful cultivation of crops during the autumn and winter months. The southern half of California and also the southern part of Arizona have, however, such conditions of temperature during the autumn and winter as are favorable to the planting and growth of crops during these seasons of the year; and fortunately, also, the heavy rains of California occur during the late autumn and early winter, which favorable condition extends to a much slighter degree over the southern part of Arizona.

It is not part of the province of the Weather Bureau to dwell upon the question of storage of water by reservoir, but it is believed that it is expected that the Chief Signal Officer should set forth clearly such physical factors of the question as pertain to meteorology and climatology. What has already been said shows, however, that over very extensive sections of the arid regions the heavy rains from which must be derived waste water for irrigating purposes come at such a period of the year as to render it necessary to keep the water stored for a long time before it can be generally used for irrigating purposes; that such storage occurs in countries and under conditions where evaporation proceeds rapidly and to a degree almost unequaled in any other part of the world; and also, that the violent rainfalls are in such quantities and cover such an area of country that the whole of these waters can not be stored; and that where storage facilities are provided they must be of most durable and solid construction, with such facilities for carrying off waste water as will render the recurrence of calamities similar to the great disaster on the Hassayampa River in Arizona practically impossible.

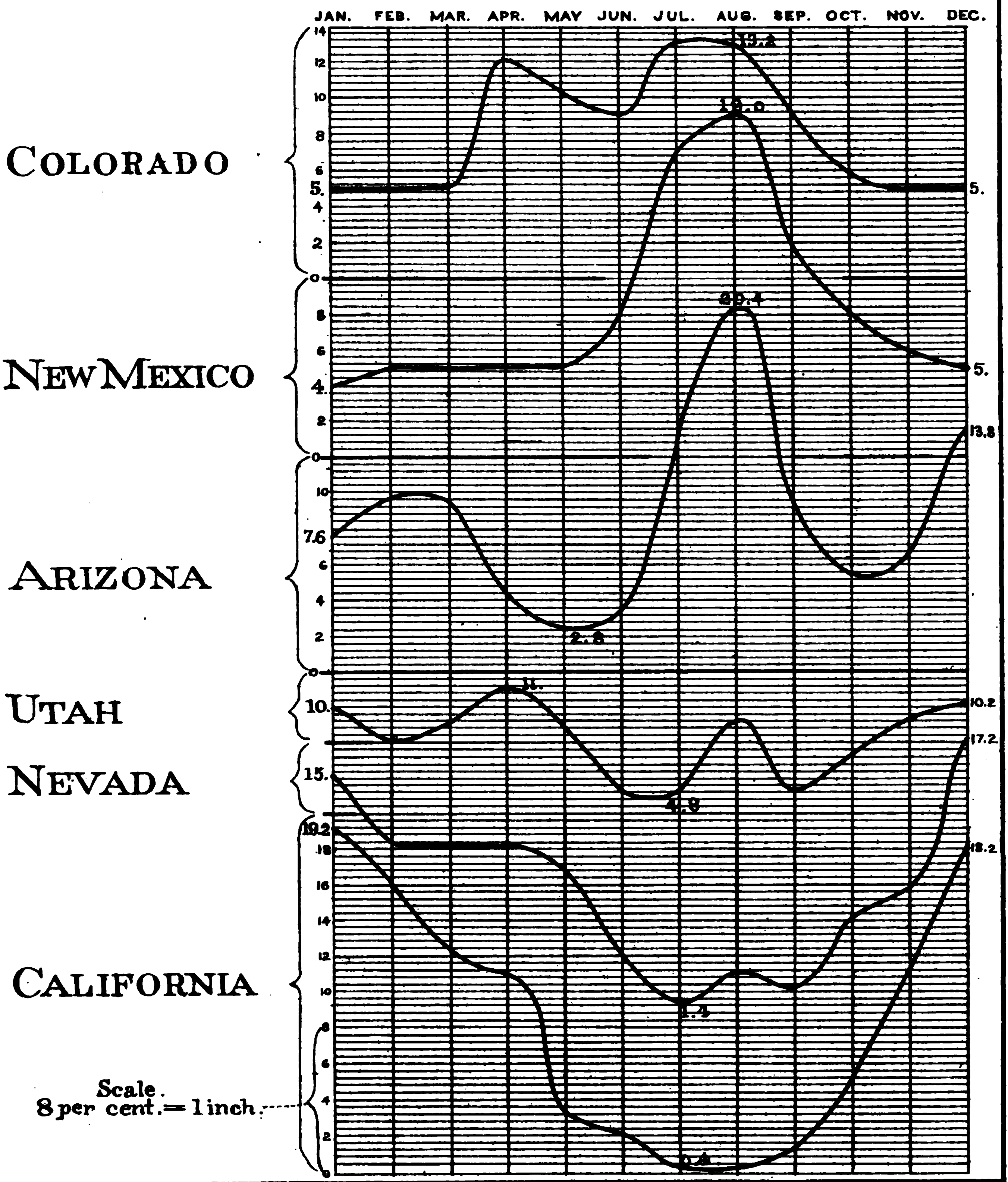
The Chief Signal Officer attaches to this report tables of precipitation and temperature which have been prepared under his personal direction, with reference to Arizona, California, New Mexico, Nevada, and Utah; together with certain charts intimately connected therewith. He further appends memoirs upon the climatic conditions with reference to irrigation, for Arizona, California, Nevada, and New Mexico, prepared by First Lieut. William A. Glassford, Signal Corps; which will further supplement the more general report of the Chief Signal Officer, and will further illustrate the tables and charts attached to the main report.

The effect of the wind in connection with evaporation has elsewhere been referred to. The velocity of the wind is also a factor not to be neglected in treating the question of storage of water for irrigating purposes. It furnishes an economical and effective motive power which has to some extent been utilized in the arid regions, but which in the coming years must prove to be a valuable agent in storing water, whether used in raising it, as possible, from the Missouri River to irrigate the plains of the Dakotas or in raising artesian water which has not sufficient head to bring it to the surface of the earth at the desired point. The average daily and hourly wind movement is given for five stations in Arizona in Appendix No. 10. The data for Phœnix are given as being the locality where the wind is perhaps the feeblest of any point in the arid regions. As a general rule it may be said that the average hourly velocity for the arid region diminishes from a maximum of 7 to 10 miles in the spring months to a minimum of 5 to 7 miles in the late summer and fall months.

## APPENDIX No. I.

# CURVES TYPICAL OF THE NORMAL PRECIPITATION.

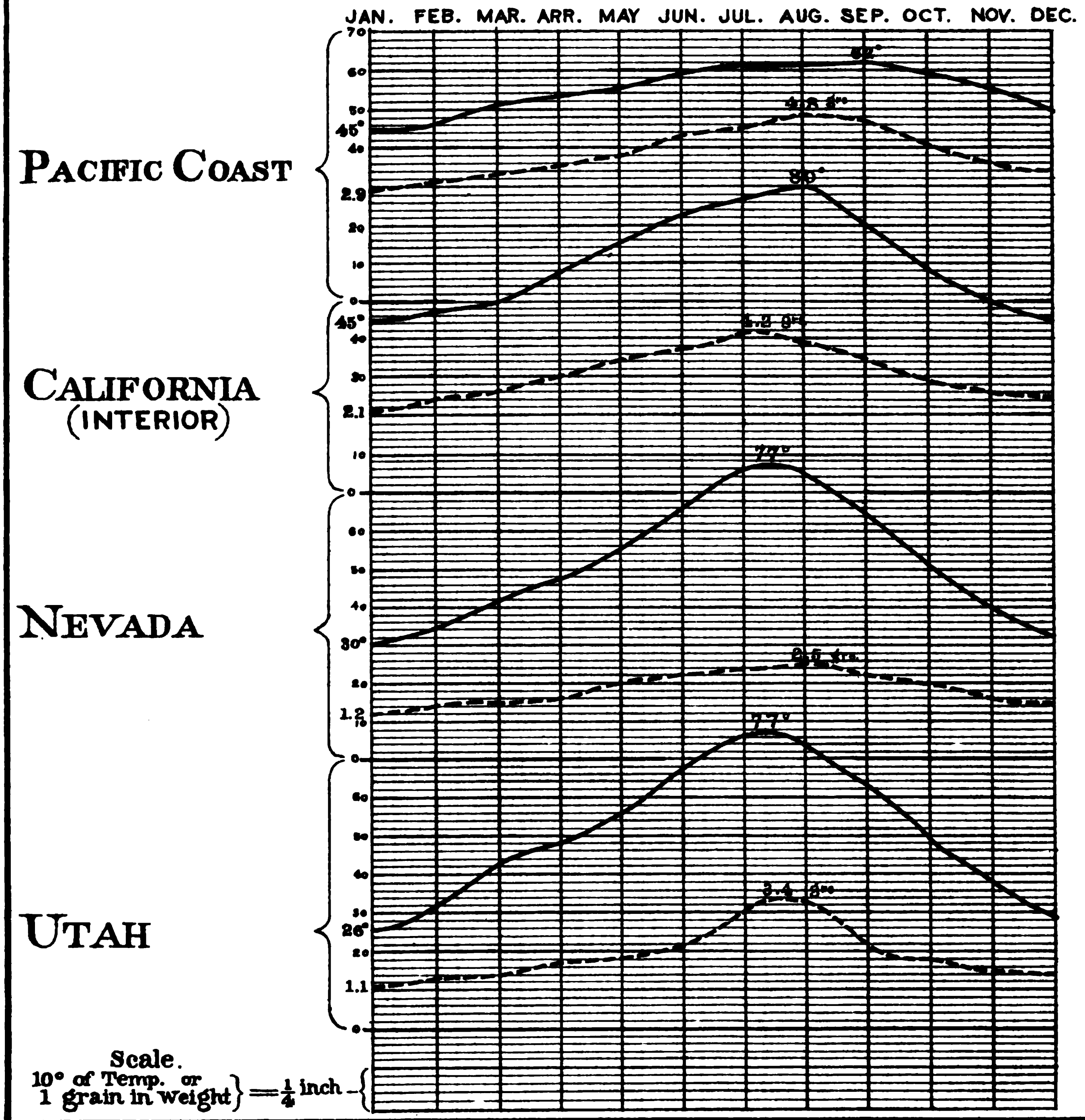
The values for the several Months are expressed as a percentage of the Annual Precipitation.



# CURVES TYPICAL OF THE NORMAL TEMPERATURE AND WEIGHT OF AQUEOUS VAPOR.

———————— Indicates Temperature in degrees F.

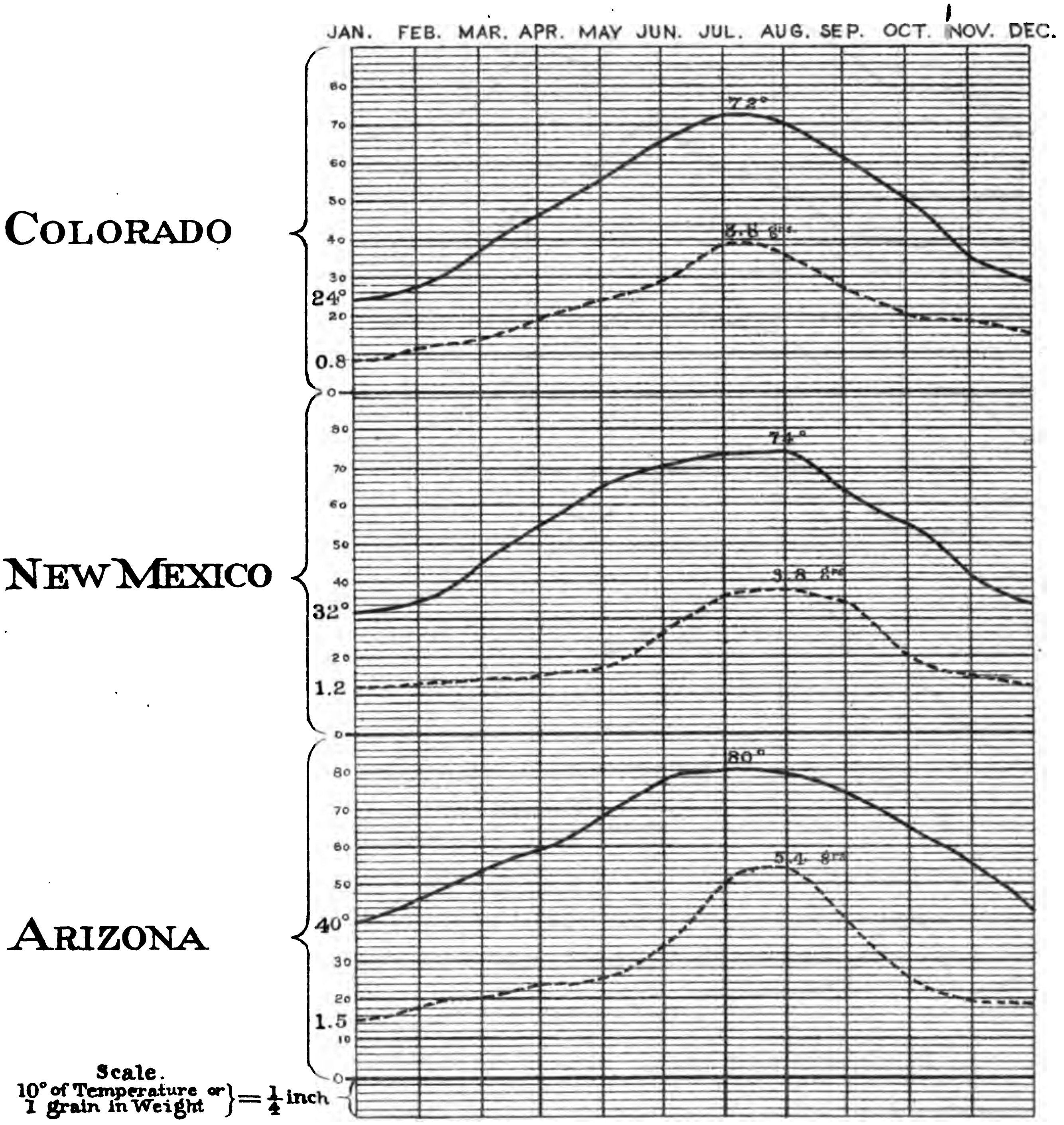
- - - - - - - - - Indicates grains of Aqueous Vapor in each cubic foot of Air.



# CURVES TYPICAL OF THE NORMAL TEMPERATURE AND WEIGHT OF AQUEOUS VAPOR.

——————— Indicates Temperature in degrees F.

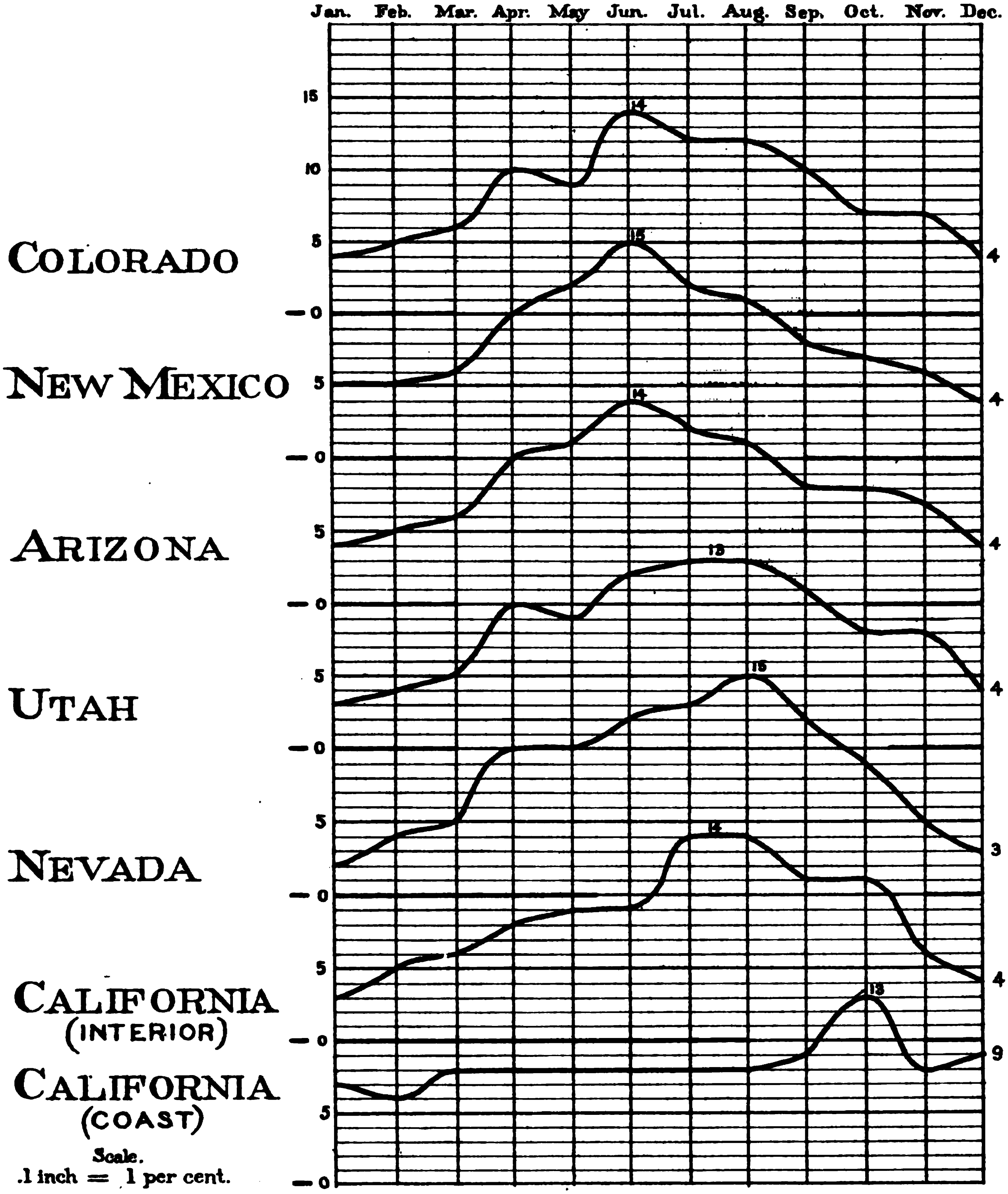
- - - - - - - - - Indicates grains of Aqueous Vapor in each cubic foot of Air.



## APPENDIX No. 4.

# PERCENTAGE OF EVAPORATION.

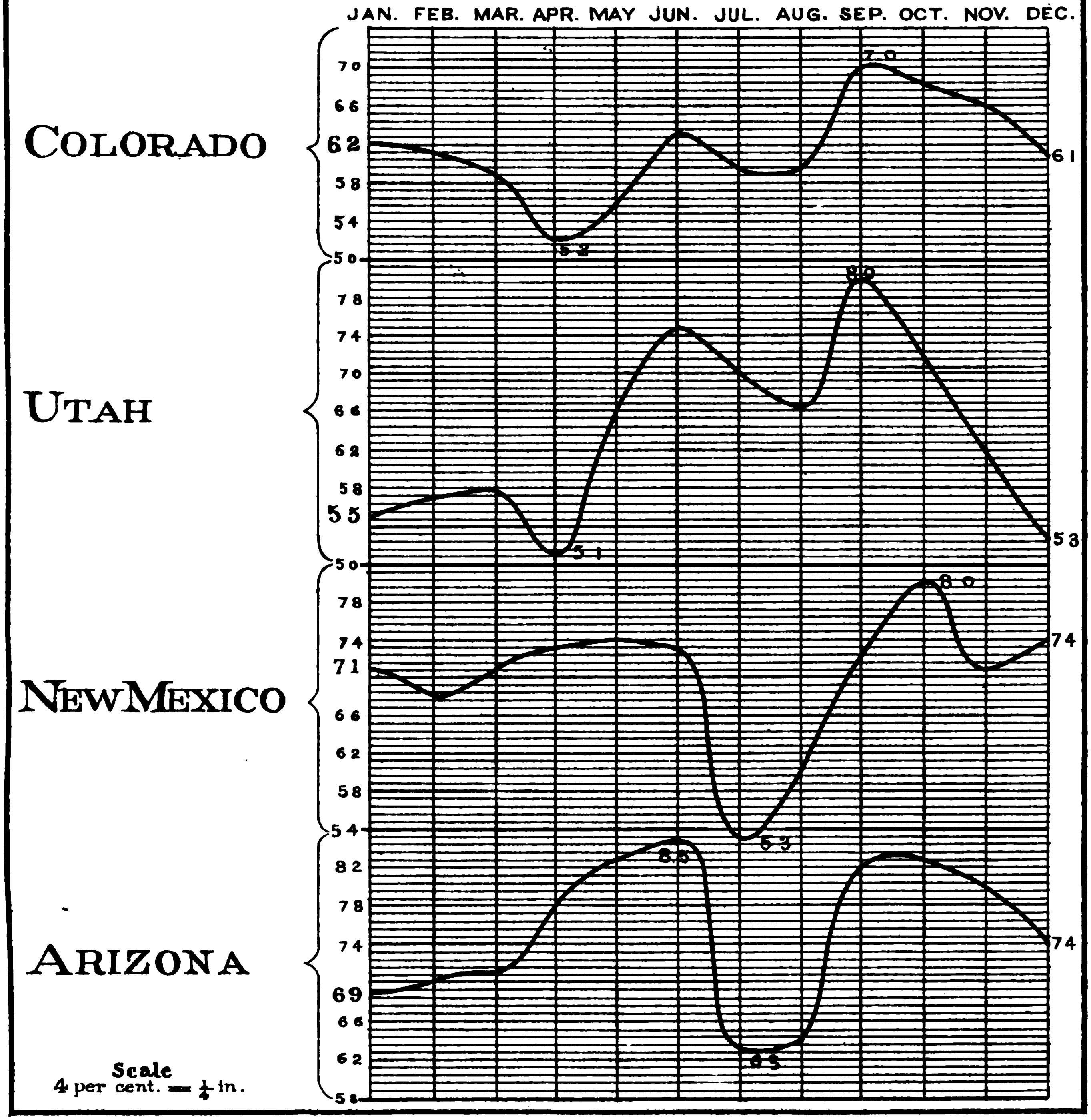
The values for the several months are expressed as a percentage of the annual Evaporation.



## APPENDIX No. 5.

# PERCENTAGE OF SUNSHINE.

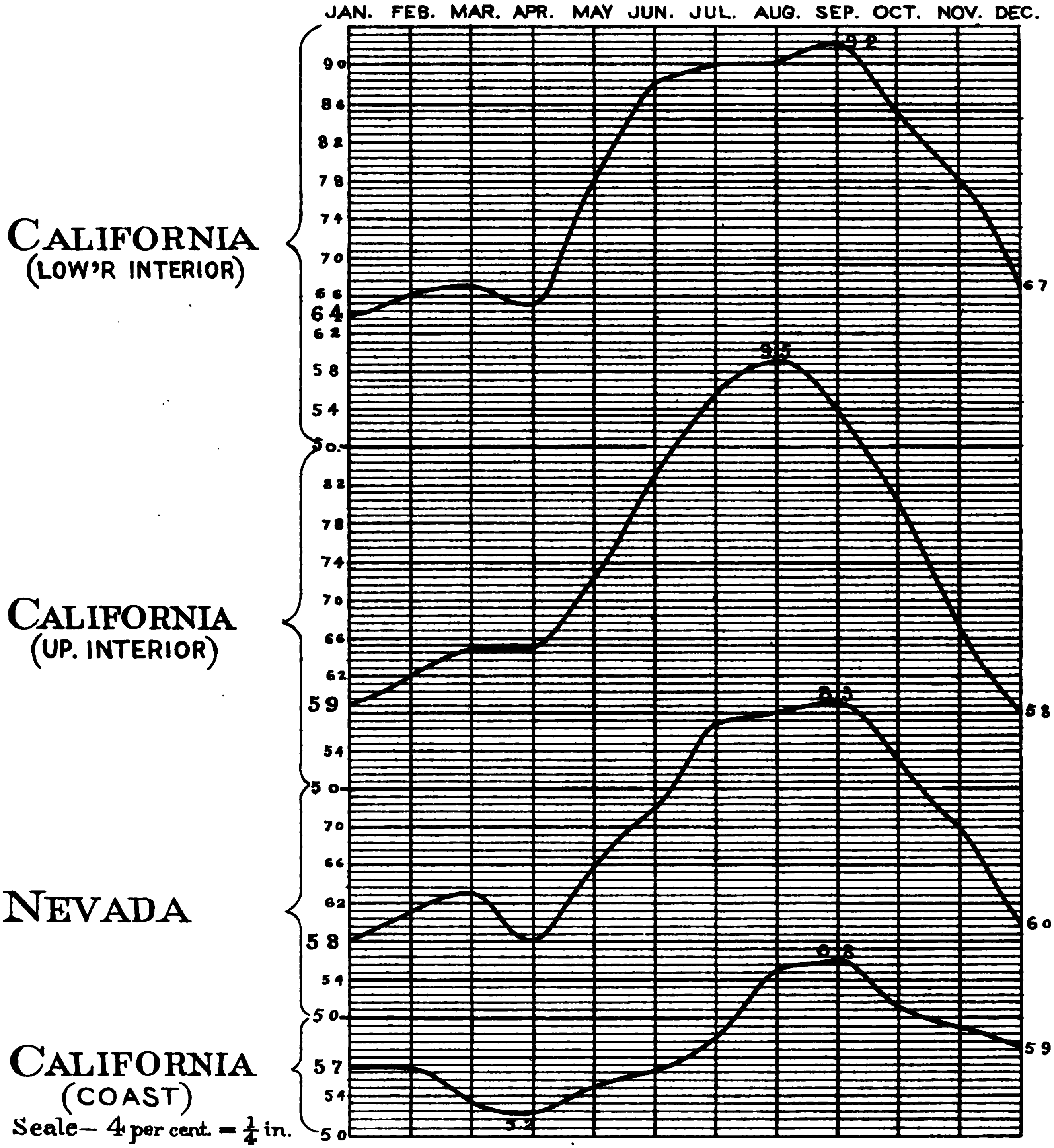
100 Represents Continuous Sunshine.



## APPENDIX No. 6.

# PERCENTAGE OF SUNSHINE.

100 Represents Continuous Sunshine.



# CLIMATE OF ARIZONA, WITH PARTICULAR REFERENCE TO THE RAINFALL AND TEMPERATURE, AND THEIR INFLUENCE UPON THE IRRIGATION PROBLEMS OF THE TERRITORY.

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SIGNAL OFFICE, WAR DEPARTMENT,
*Washington City, December 4, 1890.*

SIR: Acting under your orders, which included a copy of the resolution of the House of Representatives, I have prepared a report upon the climate of Arizona. The text of this I have the honor to submit to you, together with tables of rainfall and temperature, and charts, as noted below.

When published as an individual monograph, after the course you followed in publishing the report on the climate of Nebraska, it will be possible to distribute to the citizens of Arizona only such matter as immediately concerns them, and there will thus be effected a most considerable saving of the public funds. Your own review of the broad principles and general features of the region at large will be an indispensable introduction to the more particular and local examination, which alone has been within my power.

Concerning the report, the tables, and the charts, a few words may be said. The tables present the records of rainfall and temperature noted at the several stations which have been maintained in Arizona for less or greater periods. In some cases, where otherwise valuable records were briefly interrupted, their continuity has been maintained by interpolation of mean values, a justifiable approximation, without which climatic examination of many districts would have proved impossible. Such interpolations are clearly indicated by brackets.

The maps have been provided with systematic contours of altitude derived from the unpublished data of the U. S. Geological Survey, which information was put at the disposal of the Signal Service through the kind personal interest of Mr. Henry Gannett, of that survey.

In the text of the report, attention has been particularly directed upon such climatic factors as seemed pertinent to the scope of the inquiry which was especially authorized, as a contribution to the study of irrigation within the Territory, on such data as properly are included in the province of the Signal Service. Other climatic features have been considered solely as collateral to this main topic, and have received attention at greater or less extent according to their influence upon the rainfall. There have thus been introduced incidental investigations of temperature, winds, and evaporation. In general, it is to be said that the memoir is primarily designed to present to the last degree of accuracy climatic facts of record up to date, in order that not only may the irrigation problem be studied with a full acquaintance with the facts of nature concerned in such study, but that the data here presented may serve as a basis for future study of the Arizona climate, and possibly interest yet other citizens of that growing Territory to provide still more material by undertaking voluntary observations. Secondarily, an effort has been made to harmonize all this mass of material into a consistent review of the climate, with particular presentation of certain preponderating influences. It is believed that no statement has been made which is not amply justified by the existing data, yet it is possible that, at some later period, the mass of data may become so much more representative of the entire Territory that the present memoir will be brought under rigid review. In that case it is confidently expected that while some statements may be found to need modification, the general tone of the results herein attained will receive confirmation.

The discussion of the scientific meteorology of the region has been reserved for the memoir of like nature which deals with California. In that an attempt has been made to explain the causes of the peculiar seasons of the Pacific States and Territories, and to show their intimate correlation with the climatic laws which rule the whole United States.

Very respectfully,

W. A. GLASSFORD,
*Second Lieutenant Signal Corps, Signal Officer and Assistant.*

CHIEF SIGNAL OFFICER.

## ARIZONA.

### INTRODUCTION.

Any inquiry into the reclamation of lands at present arid in Arizona would be essentially incomplete which confined its scope to the mere noting of the position, area, and character of the soil capable of such reclamation, of the amount of water which may be drawn from the existing sources of supply, and of the engineering problems presented in the construction and maintenance of dams and other appliances for collecting and storing the waters, and of aqueducts, flumes, and other conduits to bring the water upon the soil which so greatly needs it. These are indeed of prime importance. It is necessary to comprehend clearly these factors, the reclaimable area, the hydraulic potential of the rivers and other streams, and the ease or difficulty, as a problem of pure engineering, of applying the hydraulic potential to the reclaimable area and transforming its aridity into fruitful fields. Yet, important as are these factors of the inquiry, they are not ultimate. They belong naturally in the province of the geographer and the engineer. They are results; their determining causes must be closely studied before it becomes possible to appreciate their full bearing, and it is this study of original causes which may be expected from the Signal Service.

The rich alluvial bottom lands of the valleys of the Gila, the Hassayampa, the Colorado, the Rio Verde, the Salt River, are the objects of the attention of the investor and the settler who can claim and command the services of engineering science. The causes are to be sought by the meteorological student, who will find them in the physical geography of the district and its hyetophysics. The origin of every grain of humus in the basins of the lower rivers is to be found on the jagged mountain peaks, on the bare plateaus, and in the eroded cañons of the central and northern portions of the Territory; the origin of every drop of water that flows to waste upon the shoals of the Gulf of California, of every inch of water that by wise forethought has been applied to the moistening of a soil, so rich as to need no reinforcement of artificial fertilizers, must be sought in the winter and summer rains, in the lingering mountain cap of snow, and in the destructive suddenness of the so-called cloudburst.

These are the elements of the problem, which must be presented briefly and succinctly in order that it shall be clearly appreciated from the outset, that:

(1) The causes which have produced the alluvial bottom lands are of continual and present operation, and are to be counted on to restore all waste, whether it be the molecular loss of soil washed away as detritus or the chemical waste of soil depauperated by the growth of crops.

(2) That these causes must be accepted as constant factors, not to be altered or avoided, but whose action may be diverted to channels which shall aid rather than retard the enterprise of human industry.

It is, then, a necessary preliminary to the study of the arid land and its availability for reclamation, that a presentment be made of the essential features of the district (which it happens is very nearly coterminous with the Territory), of the phenomena of aqueous precipitation and of climatological data incidental thereto, which may be properly comprehended under the general designation of hyetophysics; and, finally, of the manner in which these mutually interacting forces combine to produce the resultant known as the arid land of Arizona.

### PHYSICAL GEOGRAPHY.

It is well within limits to remark that this Territory presents the problem of rain catchment and water storage and economical distribution, together with notable reclaimability of the land to be irrigated, in terms of almost ideal simplicity. Not a single component of the problem needs determination; every one is evident, and the answer is but the accurate sum of known quantities.

This is true despite the great area of the territory. The principle which holds good on every farm where water is drawn a few yards from spring or pool is here equally plain, although every factor is magnified a thousand fold; for yards read miles, and instead of a single farm consider an area as great as that of Italy, double the measurement of the six New England States combined. Italy numbers its drainage basins by the score, New England by the dozen, Arizona but by a single pair. If extreme simplicity marks the river systems the mountain system is no more complex. It is this uniformity of the lasting determinants of the character of the land which has made the study of the irrigation potentialities of Arizona at once so plain and so interesting, and which has brought it to pass that this study must take rank as an almost absolutely necessary primer to the study of lands where the same factors are presented in far more complex combinations, and where occur many complications which must be eliminated.

This simplicity plainly appears from the summary topical arrangement which it is possible to make of the physical data of the district under consideration.

*Orography.*—The axis of the mountain system of Arizona is remarkably well defined and appears with the utmost distinctness, not only in the general trend of the main mass of elevation, but also in minor ranges, and notably in detached spurs often widely separated from the plateau system to which, on the score of altitude, they may claim to belong. With sufficient accuracy to satisfy all legitimate demands of the present inquiry, the direction of the mountain axis may be placed at northwest and southeast. That this is true in the main system will at once appear from a glance at any map; its corroborative repetition in the detached spurs is sufficiently noteworthy to call for a moment's consideration. Thus upon the bench or mesa of less than 3,000 feet of altitude there appear two interesting groups of long and narrow mounts which exhibit most unmistakably the characteristic axes. One group which flanks on the west the valley of the Rio Santa Cruz, in Pima County, contains fifteen members rising to an altitude of more than 3,000 feet from a mesa 2,000 feet high; of this number six reproduce the distinctive trend of the system, six more vary from it but slightly, and no more than three present a divergence as great as 60°. A still more characteristic butte system on the same horizon is found in the Gila Valley, just north of latitude 33° in Maricopa County.

Of the twelve members of this system, four rise from a mesa of 2,000 feet of altitude to a height of more than 3,000 feet, the remainder rise from a bench 1,000 feet lower to a height of 2,000 feet, and two of these latter to more than 3,000 feet; not one member of the system diverges from the characteristic axial direction. The table-land of 3,000 feet is crowded with sierras of 5,000 feet and upward, whose direction indicates beyond a chance of doubt the prevalent mountain-making forces which have here been at work. Even the lofty plateau of 5,000 feet shows in two systems six examples of considerable mountain masses of from 7,000 to 9,000 feet, rising at one point to more than 13,000 feet; the systems themselves and their individual members show this same axial inflection. Nor is this confined to surfaces of elevation only, many of the rivers which flow in cañons of erosion take the same bearing; for instance, the northwesterly flow of the Colorado Chiquito, in Yavapai and Apache counties, of the San Pedro in the counties of Cochise and Pinal, of the Gila in Graham County, and the Santa Cruz in Pinal, while the southeasterly flow of the Rio Verde and many of the confluents of the Salt River in the middle of the Territory, shows the same direction but with opposite sign. In passing it is well to note an important result of this uniformity of the mountain axis carried out consistently over more than 500 miles, and one which will receive more extended consideration in its proper connection, and that is that the prevalent moisture-bearing wind is from the southwest, at right angles to the broad side of the mountains, and thus encounters the maximum bluff surface. In other words, the passage of the rainy winds across Arizona is by no means an easy gliding over an inclined plane, but the laborious ascent of a flight of steps.

This Arizona link in the western member of the great continental V divides the Territory in the characteristic northwestern direction at the altitude of 3,000 feet. The division is not merely one of contours and rock masses, the line which marks the altitude of 3,000 feet marks with equal distinctness an important difference in the soil, an astonishing difference in climatic features, and so great a difference in commercial and economical value that it at once suggests the idea that nature has here balanced means with end. The partition is unequal, southwest of the dividing line, roughly speaking, one-third of the Territory lies below the level of 3,000 feet, northeast of the same line two-thirds of the Territory is lofty plateau. The plain has the fertile soil and the minimum of rain, the plateau receives abundant rain upon its rocky surface and retains almost none of it, the plain is the garden, the plateau is the reservoir of water and the storehouse of life for the soil on a grander scale than any efforts of man could accomplish.

In the present inquiry this term, the plain, will be used with definite intention as including that southwestern portion of the Territory lying below the contour of 3,000 feet and embracing the counties of Yuma and Pima and most of Pinal and Maricopa, together with narrow prolongations along the valleys of the Hassayampa, the Agua Fria, the Verde, the Salt, the San Pedro, and the upper waters of the Gila. Save a small number of exceptional instances whose acreage is inconsiderable in comparison, the plain thus defined contains the lands economically available for reclamation.

As an intermediate or transitional step before reaching the plateau of Arizona there exists a bench of from 3,000 to 5,000 feet, which, from its geographical and physical relations to the high plateau which covers fully half the Territory, may be distinguished as the proplateau. It closely follows the axial inflection of the mountain system, although its continuity is somewhat interrupted by more or less detached spurs of its higher neighbor. Across the central portion of the territory it preserves with considerable uniformity a mean width of less than 100 miles. Widening at the cañon of the Gila it covers the whole southeastern corner of the Territory. As geographically it occupies an intermediate portion between the high and the low, so climatographically it occupies a similar position and combines in its valleys the fertile soil of the plain with the abundant rainfall of the plateau.

More than half the Territory is measured above the 5,000-foot contour and forms an approximately level mesa which may be distinguished as the plateau. Though for the most part level, there are extruded from the plateau two systems of summits rising above the 7,000-foot line, and in one case attaining the altitude of 13,000 feet. That these summits play a part in the climatology of Arizona similar to the familiar mechanical functions of the governor in the steam engine is incontestable, the measurement of the influence is necessarily imperfect at present, and will provide a problem whose discussion and solution will prove of the utmost interest to the meteorologist.

*Potamography, the river systems.*—Two great river systems are distinctly noted in Arizona, divided as to their watersheds by a height of land whose direction must be discussed under two arguments according as it is traced in the plain and proplateau or in the plateau.

North of the great divide is the watershed of the Colorado, embracing approximately half the Territory and scored by a small number of affluents of the river which gives the watershed its name. Few in number and small in size they serve amply to carry off the water of an area of scanty rainfall. The more important members of the system in order down the course of the Colorado are the Rio de Chelly, draining through the San Juan River of Utah the district watered by the rains which are precipitated by the influence of the highlands of the province of Tusayan and the land of the Navajos, the Colorado Chiquito draining an area which receives its rains from the northern face of the height of land, Cataract Creek draining the area influenced to the north by the San Francisco mountains, and, finally, Bill William's Fork which, through the proplateau and plain, drains the face of the plateau to the west of Prescott in a portion of Yavapai County and throughout the county of Mohave.

South of the great divide is found the much more important watershed of the Gila and a river system of many confluents, each of which is of sufficient engineering and economic importance to need consideration as possessing an independent though tributary watershed of its own.

These tributary members of the system are, in order down the Gila's course, these: the Upper Gila watershed, embracing Graham County and the northern portion of Pinal; the two southern members, the San Pedro and Santa Cruz watersheds, of which the San Pedro embraces Cochise County and southeastern Pinal, and the Santa Cruz embraces eastern Pima and vanishes in southwestern Pinal; the three northern members are the watersheds of the Verde and Salt, the Agua Fria, and the Hassayampa; the Verde and Salt watershed covers the county of Gila, an important portion of Apache and Maricopa and much of Yavapai; the Agua Fria watershed in Maricopa and Yavapai is included within the Verde system, and the Hassayampa watershed within the same counties forms a narrow but fertile valley system paralleling the Agua Fria; last of all is the watershed of the Lower Gila, which embraces the agricultural wealth of Pima, Maricopa, and Yuma.

The direction of the height of land which forms the great divide between the watersheds of the Gila and Colorado must, as has been said, be discussed under two arguments. That portion of it which lies within the plain and proplateau is traced with considerable exactness perpendicular to the face of the plateau and the mountain axis. Upon the plateau itself it is drawn with a somewhat free hand in the direction of the mountain axis which has already been shown to play so considerable a part in the present inquiry. The line thus drawn does somewhat more than serve to show the division between the rivers of the north and the rivers of the south; examined in correlation with the isohyetal curves it indicates a modifying circumstance which will receive further consideration. It suffices here to note that the maximum of rainfall is found with interesting regularity to the southward of the divide. North of it the rivers flow for the most part in deeply eroded cañons, south of it are level valleys and basins which it is clear have within recent geologic time contained immense inland seas of the order of Lake Bonneville, of the similar region immediately to the north. One such basin is clearly discernible in the region where Yavapai and Apache corner upon the county line of Gila, a basin known as the Tonto Basin.

### PRECIPITATION.

In the study of the precipitation phenomena of Arizona preliminary note should be made of a correction which must be of constant application in all computations, with one exception hereinafter expressly made and discussed, a correction of quite uncertain amount but of uniformly positive sign. The need for this correction arises from the fact that the stations of meteorological observation are for the most part in valleys or cañons while the heavy rains occur upon the tops of the mountains or at least high up on their slopes. It is a matter of frequent occurrence in the experience of every observer to note an absolutely dry rain gauge at the point of observation while the surrounding mountain tops are black with storms and every *arroyo* is filled with a torrent of muddy water. Nor is this conclusion confined to the mere sight of showers which go unmeasured. During the winter the most casual observer of the streams sees periods of high water amounting at times to turbulent flood, which are so little to be accounted for by the record that the conclusion is irresistible that existing records indicate only a fraction of the actual precipitation which can be relied upon for water storage and that these data represent perhaps the minimum quantity of the rain fall. Yet despite this known disproportion of the recorded and actual efficient rainfall it will be shown in this discussion that the measured amounts are sufficient to supply water for the irrigation of much more land than the acreage known to be available.

*Mean annual precipitation.*—The division of the Territory by contours of altitude into the markedly distinct regions to which have been applied the terms plain, proplateau, and plateau serves equally well to mark the division between two radically variant systems of isohyetal curves. The line of demarcation between the plain and proplateau which in nature is plainly indicated by cliffs and bluffs undergoes no change at all when transferred to the meteorological chart as the curve of 10 inches of annual precipitation, and in the one case as well as in the other it reproduces the characterizing axial inflection of the mountain mass. The plain, then, the entire southwestern portion of the Territory, has been marked off by nature not only in walls of rock, but in water as well, to receive consideration by itself.

It has no great mountain heights nor large masses of elevation. With gentle slopes it falls off toward the sea level of the Gulf of California. Because of this absence of mountains it may be considered as almost exempt from the operation of the otherwise constant correction just noted, and on this account the lines of precipitation drawn upon it may be held to be reasonably accurate. Two such curves below the line of 10 inches may be indicated with interesting results. The curve of 6 inches in Pima County follows quite closely the contour of 2,000 feet under the directing influence of the Quijotoa Mountains, then reaching the Gila Valley below the Maricopa divide, it follows the river for some distance and finally passing to the eastward of the Castle Dome Mountains runs northward in the Colorado Valley and out of the Territory at Fort Mojave. The curve of 4 inches may be drawn with close fidelity to the contour of 500 feet both in the valley of the lower Gila and the Colorado as far as the mouth of Bill William's Fork. Upon this low plain the rain records approximate the absolute minimum of the world. It is from the reports of early travelers in this region, as rainless as the Saharas or the central plains of Australia, that has sprung the common belief that Arizona was agriculturally worthless because of its aridity. Hunters and trappers in search of game, emigrants wearily accepting the desert as the hard path leading to the promised fatness of California, prospectors seeking placers and pockets had neither time nor inclination to think of aught but the means of protection against the Indians. They found their road lying over sandy plains where springs were far away and where the sky was seldom clouded with rain. Carelessly they called the land a desert, carelessly their hasty decision spread, and now this prejudice founded on ignorance and faulty observation yields but slowly to the argument of facts.

The proplateau is so narrow a strip for the greater part of its length and so vestibular in its relation to the plateau that in the absence of climatic data it should be provisionally included in the great plateau mass which overshadows it. This may well be done with all that portion lying northwest of the Gila. The southeastern expansion of the proplateau embracing portions of the counties of Graham, Pinal, and Pima and the whole of Cochise is so marked by two systems of extrusive highlands, each composed of a considerable number of extensive masses of elevation reaching in every case the altitude of the plateau and in some cases 1,000 or 2,000 feet higher, that this region may be rationally included in the discussion of the rain-making influence exerted by the extrusive summits of the plateau.

Turning next to the plateau which covers more than half the Territory, and examining the correlation of its isohyetal lines with such other physiographic curves as have already been indicated in the present discussion, an interesting correspondence becomes at once manifest. With one exception the isohyetal curves tend to follow the axial inflexion of the mountain mass. With sufficiently remarkable regularity the curves of annual rainfall, amounting to more than 10 inches, fall quite to the south of the great divide and thus indicate for the Gila watershed a considerable superiority of water supply over the Colorado system. (It should be carefully borne in mind that the terms of the discussion limit this statement restrictively to that portion of the Colorado system alone which is comprehended within the territorial limits of Arizona and that no reference is intended or allowable to its watershed in Utah or Colorado.) Not only is this true of the Gila system in general, but it appears in particulars as well. The San Pedro confluent drains an area within a curve of high rainfall, the upper Gila itself has its feeders upon slopes similarly well watered, the Salt River derives its supply from another portion of the same area, and the Verde, the Agua Fria, and the Hassayampa all penetrate one and the same area of markedly high precipitation.

It has been noted that the isohyetal curve of 10 inches draws in water the division between the plain and its loftier neighbors. The curve of 15 inches in the present condition of the available data can be drawn only in the southeastern expansion of the proplateau where it waters the region drained by the Santa Cruz and San Pedro rivers. The curve of 20 inches appears in four branches. The first includes a small district in the southeastern expansion of the proplateau to the southeast of Tucson and is definitely superimposed upon the Santa Rita Mountains. The second appears as to a certain extent coterminous with the elevated mass of the Natanes Mountain group, and thence has a narrow southeasterly projection between the valleys of the upper Gila and Salt rivers, toward Phœnix and Florence. The third very closely traces the flanks of the Mogollon ranges and includes the San Francisco mountains which are adjacent by but a small interval. The fourth is narrowly confined to the region of the headwaters of the Hassayampa, the Agua Fria, and the Rio Verde in the highlands of the vicinity of Prescott, which although in altitude a component part of the plateau yet appear and apparently exercise the hyetal influence of a mass extrusive to the proplateau. Of these three latter systems of curves of 20 inches each one employs as a large portion of its exterior boundary the line which divides the two watersheds, and only a narrow minimum of its influence can be shown to be exerted on that side the divide which makes the drainage basin of the Colorado.

The characteristic and marking curve of the southern portion of the plateau, or that portion which forms the watershed of the Gila, is the isohyetal curve of 20 inches. Isohyetals of 10 inches appear sporadically (at least in the present state of knowledge a systematic correlation does not appear) in three instances in the Gila watershed, while just beyond the divide an extensive curve of 10 inches in Apache County shows plainly the drier character of that moiety of the plateau. The Gila system shows a curve of 10 inches in Cochise County corresponding with the Sulphur Spring Valley. Another is in the shape of a long loop of a New Mexican system extending far up the San Simon Valley in Graham County. The third is a circle of short radius drawn about Willow Grove in the western part of Yavapai County. In but one instance is there drawn a curve higher than the normal, and that is the line of 25 inches, which narrowly accords with the roots of the San Francisco mountains.

*Rainy seasons.*—A very favorable provision is found in the fact that Arizona has two plainly marked rainy seasons, a fact which largely balances the relatively small precipitation. In this, as in every particular of the study of precipitation in the Territory, it should be noted that the physical features are such as to lead all rain precipitation down steep mountain sides, everywhere approximating perpendicularity, with such rapidity that the surface which receives the rain is little benefited thereby, and the valleys are almost instantly affected.

The season of winter rains begins in December with a marked absence of precision in definition, but at the other end in February their termination may be predicted within narrow limits. The precipitation during this season is neither so great nor so much to be relied upon as the rains of summer, yet it serves a regulating purpose whose direct influence upon the climate and the more particularly hydraulic features now under discussion is persistent for months after the definite conclusion of the season which produced it. The precipitation of this season is both heavy and general while it lasts. The season presents a series of weather types which have been the subject of some study in connection with their annual and secular appearance upon the Pacific coast. In brief, the storms are of the sort conventionally known as cyclonic or low barometric areas between which are interpolated anticyclonic areas marked by extreme cloudlessness and slight humidity. As in the case of the seasonal rains of California, so in Arizona, the variability of the winter rains in amount and frequency is in the ratio of the intensity and recurrence of barometric disturbances. To this characteristic feature is due the intermittent effect of the rainfall, which gives the streams both high and low water during the rainy season. To such an extent is this tendency carried that in time of drought some of the streams become mere rills, and even disappear altogether either because of total failure of the source of supply or because the water has sought underground channels beneath the great deposits of detritus, sand, and silt that have washed into the beds of the streams on account of the rapidity of passage of rain water to a distinctly lower level over mountain sides of notably steep pitch.

Despite the fact that the amount of rain precipitated during the three winter months is measurably less than in summer it never fails to flood the streams. The reason for this has already been indicated in the sharpness of the contours of altitude. The low temperature which prevails upon the plateau during this season also tends to magnify this result. The soil of the mountains, naturally little pervious, is made still more impermeable by the freezing of rains upon it so that succeeding rains fall upon glare ice and are hurried to the valleys with a minimum of absorption by the soil. Much of the precipitation of the winter rainy season occurs in the form of snow which is retained upon the spot where it falls. Succeeding falls add to the depth of this mantle of stored water until it is by no means unusual to find it on the mountains all the way from 3 to 7 feet deep. It thus appears that the total winter precipitation is naturally resolved into two components of which one, the rain precipitation, has an immediate though evanescent effect upon the streams, while the other, the snow precipitation, exerts an influence more permanent in proportion as it is less immediate. This mantle of snow is in fact a great storage reservoir with neither dam nor dike, and automatic in its regulation of supply to the causes which avail to produce demand. It remains upon the plateaus of high altitude on which it has fallen for months after the definite conclusion of the rainy season and is frequently observed to persist until nearly the beginning of July. Its gradual melting serves to keep a quantum of water in all the streams throughout the dry season almost to the beginning of the summer rains.

The summer rains come in July, August, and September, being somewhat sharply defined from the preceding dry season, but shading off so indeterminately toward the beginning of the winter rains that it becomes quite proper to say that while Arizona has two rainy seasons it has but one dry season. Although there is no positive delimitation of time between the rains of summer and those of winter there is to be noted a differentiation of character. The rains of winter are caused by the proximity of approach of great storms in low-pressure areas which form a part of the storm system of the country at large. The rains of summer are local in character and directly traceable to mountain influences, with a distinguishing peculiarity which should be noted for future study. In general the amount of rainfall is greatest in districts toward the point from which the prevailing wind blows; in Arizona the greatest pluvial effort is registered on the leeward side of ranges. A noteworthy feature of the climatology of the Territory is that when the last snow disappears upon the mountain summits the summer rains commence. So constant and so well appreciated is this relation that the oldest settlers, and the Indians before them, have been in the habit of calculating the coming of the rains in accordance therewith.

It has been noted that the summer rains are of local character; they appear somewhat upon the plain, but their maximum amount and intensity is displayed upon the plateau. While their total amount is considerably in excess of the sum of the winter rains the amount of any individual precipitation is uniformly less than any one precipitation of winter, and the excess is made to appear through the sum of a long series of precipitations which are of almost daily occurrence upon the mountain summits. They rarely have any great extent, but their intensity is so remarkable a feature as to warrant particular consideration.

So much rain has on occasion been known to fall in a single precipitation that the term cloudburst becomes by no means inappropriate. It is a topic of the hyetophysics of the Territory on which the hydraulic engineer will demand from the meteorological service the fullest information. The records do not show many of these cloudbursts, but of the few concerning which accurate data have been secured several are to be noted as severe. Thus records at Forts Bowie and Verde, at Maricopa, Phœnix, and Yuma which have been kept for varying periods up to 13 years show not a single instance of a rainfall to be classed as violently excessive. In the class of rainfalls noted as precipitating 2½ inches or more a day the entries are few. Thus at Fort Apache 10 years' observation includes two such cases; Fort Grant in 10 years shows three cases; Fort McDowell once in the 5 years of observation, and Prescott twice in 12 years make similar records. In the much more dangerous class of rainfalls noted as precipitating an inch or more an hour Fort Apache is credited with 9 in 10 years; Fort Grant with 6 in the like term, and Fort Thomas 1 in 8 years. These are the facts of record; their discussion would involve a minute examination of local physiographic features not pertinent to the present inquiry.

In each case they can properly be considered only as an exaggeration of the normal mountain influence which directs these rains of summer, whether moderate or severe. The fact that showers are observed almost every afternoon upon the mountain summits, and most uniformly only in the afternoon, points directly to this cause, which may be briefly discussed. A well-established law of atmospheric temperature is that it decreases with the elevation, a law whose operation is easily seen upon snow-clad mountains where the snow line gradually rises with the increasing heat of summer. While Arizona has no mountains capped with snow the year around, it has many which carry snow for varying periods into the summer. During the persistence of the snow the actual decrease in temperature on the mountain sides is nearly equal to the theoretical decrease with elevation. The white snow surface by its reflection of incident solar heat tends to keep the mountain mass at a low temperature, and possibly such a surface absorbs no more heat than air of the same elevation; at best its coëfficient of absorption is small. Thence it results that above the line of actually persistent snow the vertical isotherms may be conceived to differ but slightly over the plateau and over the extrusive summits. With the final obliteration of the snow a marked change occurs. The rock surface now exposed absorbs heat and speedily converts the mountain into a radiant body of conical form. The strata of air cut by this cone of radiation and strata lying above it become at once disturbed, convection is instituted, and as the influence spreads over a considerable area great amounts of air are in a short time lifted to a great height, and in the resulting operations of expansion, cooling, and condensation the upper currents distribute the rain over the plateau and particularly to leeward. By parity of demonstration the same principles may be shown to account for the diurnal periodicity of these summer rains.

From the foregoing considerations it appears that the rainfall of Arizona, computed on the basis of the present records whose inaccuracy is know to be subtractive, is more than sufficient to irrigate the reclaimable soil, great as its extent is known to be. The maximum rainfall of any of the years for which records have been kept is not so great as to burden the usual engineering appliances for handling it, and the possibility of cloudbursts simply necessitates the construction of stronger retaining works and the maintenance of emergency wasteweirs. The great question to be considered by the engineer in connection with each stream is its hydraulic potential, the maximum amount of water available at the close of the period of minimum supply. That this is sufficient for all his uses is clear from the observations of the meteorologists of which a summary sketch has been here presented.

Yet other matters must be considered as affecting the problem set before the meteorologist, and of these there are certainly two which must be held to be proper objects of meteorological study; these are, the evaporation from water surfaces and the mechanical equivalent of wind power.

*Evaporation.*—Concerning evaporation it is difficult and would be presumptuous to speak with any claim to accuracy in results, for the reason that the study of this phenomenon is yet so young that discussion of its primal data is vague and unsatisfactory. Several atmidometers are in use and the suite of observations recorded thereby is slowly increasing; but there is this initial difficulty in the study of these records, that it has been impracticable to establish the ratio of any atmidometric record to any case of evaporation from flowing or non-flowing bodies of water, which is what concerns those most interested. It should be said that in every case the atmidometer makes its record under conditions rigidly dissimilar to those occurring in nature, and for the present it is impossible to determine in what direction and to what extent the instrumental record differs from natural evaporation. These are points which have been presented in the Monthly Weather Review for September, 1888 (p. 235), in a paper which marks the first definite step toward the study of evaporation as an essential climatographic datum.

In general it may be said that the amount of evaporation depends on the dryness of the air, the velocity of the wind, the temperature of the evaporating water, and the extent of the evaporating surface, and, other things being equal, varies inversely as the barometric pressure. It is possible also that the amount of evaporation may be reduced by the height of the banks of the reservoir, or, what amounts to the same thing, the lowering of the water level.

Instrumental records were carefully taken at a number of stations in this country between July, 1887, and July, 1888. Four of these stations were in Arizona, and the records of these posts are here presented as they appear in the Monthly Review. They serve to indicate what must be the evaporation from storage reservoirs, since even though they do not give the actual evaporation from every square inch of water surface (and this is uncertain, it is neither asserted nor denied) they yet supply a proportional scale for the comparison of reservoirs within the same or different atmidometric curves.

| Station. | 1888. | | | | | | 1887. | | | | | | Year. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Jan. | Feb. | Mar. | Apr. | May. | June. | July. | Aug. | Sept. | Oct. | Nov. | Dec. | |
| Fort Apache .... | 2.6 | 3.0 | 3.6 | 6.8 | 9.4 | 9.1 | 7.1 | 6.7 | 5.3 | 5.2 | 4.1 | 2.6 | 65.5 |
| Fort Grant...... | 5.2 | 4.8 | 6.4 | 9.2 | 10.2 | 13.8 | 12.4 | 10.5 | 9.0 | 7.9 | 7.2 | 4.6 | 101.2 |
| Prescott .... .... | 1.4 | 2.8 | 3.6 | 5.4 | 6.2 | 8.1 | 6.6 | 6.5 | 4.7 | 4.9 | 3.6 | 2.2 | 56.0 |
| Yuma........... | 4.4 | 5.2 | 6.6 | 9.6 | 9.6 | 12.6 | 11.0 | 10.2 | 8.2 | 8.2 | 5.5 | 4.6 | 95.7 |

Drawing the curves in accordance with this record it will be seen that Arizona is entirely above the curve of 50 inches of annual evaporation; that very nearly half of the territory is above the curve of 90 inches, and that it contains an area of more than 100 inches, the maximum amount of evaporation in the United States. These atmidometric curves yield yet another striking example of the correlation of the physiographic features of the Territory, since the curve of 90 inches traces very closely the 10-inch isohyetal curve and the contour of 3,000 feet of altitude; in other words, the northwestern axis of the mountain system. From this it will be seen that the greatest amount of evaporation occurs in the plain, which is the region where irrigation is destined to be applied, and that curves of high evaporation include nearly all the projected reservoirs. Yet, on the other hand, it should be noted that the enormous amount of evaporation within the 100-inch curve will scarcely affect the economic features, because in the San Simon and Sulphur Springs Valleys, over which this curve is drawn with close restrictions, present indications point to irrigation by utilizing subterranean flow of waters which are below the reach of evaporating influences.

With the view of checking, or at least modifying, the amount of evaporation the following suggestion is offered to the consideration of those who may be inclined to experiment in the hope of the great saving of water which would be the result of success. One of the most common genera of aquatic plants is *Utricularia* or Bladderwort, which has more than a hundred species, in its habitat including the torrid and temperate zones, and in this country is represented by fourteen species. The characteristic growth of this plant would seem to indicate that it may have valuable properties in the line of acting as a screen against evaporation. Its germination and early growth are at the bottom of still bodies of water. Here it grows until it has reached a length of 3 or 4 inches, loosely attached to the soil by roots which are not designed for anchoring purposes. As the time for flowering approaches the root bladders, which give the plant its name, fill with air and float the plant to the surface where it forms a thick cloak of green with fine and closely matted leaves which screen the water to an extent which should warrant experiment to determine whether it does prevent evaporation sufficiently to make its planting advisable.

After the close of the flowering season, and when the seeds have nearly matured, the floating mass sinks to the bottom, where the cellular tissue decays and, instead of forming a deposit on the bottom, is for the most part dissolved in the water. The floating period of the Bladderwort in the Southern States is from May to September. If its behavior when transplanted to the reservoirs of Arizona underwent but little change it would screen the waters during all the period of maximum evaporation when some screen would be most desirable. Concerning the possibility that it might in some way interfere with the flow in ditches it should be noted that it demands still water for its growth and that in England outlets of ponds completely covered with this growth are kept perfectly free by a current of less than 2 furlongs an hour. This is made as a suggestion that those interested may, if they see fit, attempt the experiment on a small scale and thus learn what difference, if any, will be made by the transplantation to the changed conditions of Arizona.

*Wind power.*—Enormous power goes to waste all over the land in the wind which blows and is not utilized. The question is one which has engaged the attention of mechanicians who recognize the power latent and find their difficulty not in rendering it immediately efficient but in conserving its energy. For irrigation purposes in Arizona this difficulty needs no consideration; it is sufficient to raise water into a tank or reservoir whence it may be drawn as needed. The wind may not be constant, but its direction is immaterial and the force which will operate a modern wind motor is very small. Such application of power is very clearly indicated for the fertile valleys of the southeastern corner of the Territory where abundant streams underlie the soil and may be reached by wells not more than 20 feet deep.

## IRRIGATION.

The rocks and the raindrops are the parents of the agriculture of Arizona. Mutually acting and reacting at every stage they have been at work for ages to lay upon the plain and in the eddy basins of all the rivers rich deposits of soil. Their work is by no means concluded and of the geological past; the part of man is simply to assist nature on the lines she has plainly indicated in her own operations. Agricultural Arizona betrays no evidence of disruptive violence; the jagged mountain peaks and the deeply scored valleys are in the uplands; their waste and detritus have been spread in smooth sheets and gentle slopes upon the river bottoms and the even plains. The highly landed lands of irrigated districts in other States are interrupted with troublesome frequency by hillocks which rise above the irrigable level; in the Gila and Salt River Valleys scarcely an obstacle stands in the way of the even flow of the waters.

Rich as is the Arizona soil it is always a disappointment to the farmer who views it with the prejudices born of familiarity with the deep rich loam of the prairies. At first sight he can compare it with nothing but the sand of the sea beach; that it could be made to bear a scanty crop of some hardy grass is almost beyond his comprehension; that it does bear enormous harvests of grain, that it is the rival of every vineyard country in the world, that its orchards are beyond rivalry, are facts which have to conquer belief in his unwilling mind.

This is a land of inland seas in recent geologic times. Their beaches and shoals have been laid down at several altitudes to serve as foundation for later effects of soil-making industry. To stratifying action has succeeded the mechanics of the present geologic period, which is frictional, erosive with the erosion of wind and water. The science of common things, which often goes direct to the heart of the most complex matters, has seen this fact and shows it in the names of the rivers; the Colorado, red with the suspended soil which it carries along, the Rio Puerco, dirty as the water which drains from the mire of a hog-wallow, the Salt River and Mineral Creek, proving to another sense that they carry the elements of soil.

Throughout the plateau everything is adapted to secure the maximum erosion. The raindrop falls on mountain slopes approximating the vertical and acquires such a velocity along the steep slope that it scours away some of the soil; coalescing drops become rills to score each its little gully on the rocky steep, and rills unite to form creeks dashing along with force to roll large rocks down their beds and grain by grain wear them away, and every such grain is borne far along to do some good; creeks at last grow into rivers whose velocity is great and which have a coefficient of erosion to correspond. The Gila flows down through the mountains with a fall of 4,000 feet in 500 miles; when it reaches the plain it falls but 6 inches to the mile of flow; its suspended material is deposited along this portion of its course.

The Colorado wears away its mountain bed with a fall to the mile ranging as high as 38 feet and 10 feet not uncommon, yet from the point where it begins to border the plain its flow is reduced to the uniform descent of a foot and a half to the mile. Its cañon is 400 miles long and often 20 miles in width and so deep that in places stand cliffs a mile high. This gorge, whose contents if stated by number of cubic yards would be one of those enormous numbers which the mind in vain tries to grasp, has been cut away by water, every grain that once was solid rock has been carried by water to a resting place in Arizona or in the Gulf of California below. Beside the erosion of its own grand cañon the Colorado has served as the conduit for the detritus of a great mountain region brought to similar disintegration by a host of confluent streams.

It is thus that the soil has been gathered by the waters, that it has been translated from the high altitudes to the lower, and by the water it has been deposited in a surface which is both level and uniform. The worth of such a soil is a matter dependent on the characteristics of mountain districts hundreds of miles away, and in this case no fault can be found, for the moutains are rich in soil constituents and the richness of this wealth is brought to the plain in the most finely subdivided form and thus is in the best shape for the purposes of agriculture. This soil consists generally of red clay and decomposed granite with gneissic admixtures, the whole diluted with sand, which keeps the mass ever friable, and with a sufficient proportion of true humus which will be subject to an almost constant increment under tilth.

The cellular structure preserved throughout the deposit by reason of the irregularly crystalline sand has a tendency to maintain a system of capillary tubes which are inert so long as the soil is dry but which perform a most important part when moisture is applied. As the water penetrates the mass of dry soil the capillary system becomes charged and at once begins its operation of leading toward the region of root-penetration the important chemical components of vegetable tissue stored below. The water which induces this restorative action is at the same time acting primarily upon the surface by direct molecular addition of soil. This action which goes on to a certain extent under natural conditions will proceed to a certainly greater extent under irrigation systems which are expressly designed to pass the water over the soil with a minimum velocity of flow and thus provide the most favorable conditions for dejection of the matter held in suspension.

The amount of this soil which it is known needs but the water of irrigation to become fruitful is of an extent not accurately known and has been variously estimated at from six to ten million acres, an area of uniform fertility surpassing the combined areas of Massachusetts, Connecticut, and Rhode Island. A recent governor of Arizona in his report for 1888 speaks in a general way of 25,000,000 acres to be reclaimed. With more precision the United States Land Office certifies to 2,000,000 acres of arable land in the valleys of the Colorado, the Gila, and the Salt. The governor in his report for 1887 makes the estimate that in the stretch of desert land from Yuma to the mountain ranges of Pima County, a distance of 250 miles in length by 125 in width, there is contained about 15,000,000 acres, and that to reclaim this now desert waste and make it yield an abundance of valuable crops there is only needed an artificial application of water. These, however, are questions for the geographer, not for the meteorologist.

In general it may be said that the question of the reclamation of any arid land presents itself for discussion under five topics which it is well to note. They are: (1) Geography and hyetophysics of the region; (2) amount of land which may be irrigated; (3) amount of water which may be used for irrigation; (4) economy of irrigation; (5) legal questions involved. The lines of division between these topics can not be sharply drawn, each involves consideration from several points of view and thus comes within the province of several studies. The economical and legal questions are to be settled by the intending investor and his advisers; the amount of land and the amount of water available for use upon it are to be determined by engineers; the meteorological student may in pursuit of his researches find himself involved in the discussion of any or all of these topics, but his special province is the hyetophysics as affected by the determining facts of nature. It is hoped that this account will show the Signal Service to have made the best use of its opportunities and to have fairly presented the case for the consideration of engineers.

The aridity of the territory, great as it appears on first sight, does not prove a bar to high agricultural development in the line of close farming of chosen spots nor has it in the past so far as history runs back. Nor indeed does the twilight of history obscure the fact of irrigation that existed beyond the memory of the most ancient tradition. In the valley of the Rio Santa Cruz, near Tucson, there may be still met with the ruins of ancient aqueducts of stone so old that the Indians of this day know nothing of their builders. Whoever these ancient farmers may have been they have left no trace of their history beyond the masonry of their conduits and incised thereon a mass of inscriptions which no amount of linguistic science has yet availed to decipher. To the Aztecs the Colorado was as the Nile to the civilization which came to life earliest of all history and spread its light to Europe. It fed the land with both soil and with water, its yearly rise was the only season, about it grouped all the concerns of the people. The ruins of the Colorado Valley and those of the Gila Valley whose masonry shows their Aztec origin are a mute testimony to the success which would attend the repetition of these operations of an uncivilized race.

At Mesa City, in the Salt River Valley, the Mormons of the prosperous stake there established owe their prosperity to their aqueduct system and this in turn they owe in large part to the labors of a former race of whom all knowledge has vanished. These early peoples were farmers and appropriators of water through extensive ditch systems, and when they disappeared in some convulsion of savage life they left their ditches behind as everlasting memorials. In time the drifting sand filled the aqueducts and they lay hid until the Mormons needing water found them so well preserved as scarcely to need more repairs than the mere clearing out of the sand. Near Florence, in the region containing the Casa Grande which are the most significant ruins in the country, are found old irrigating ditches choked in places by streams of lava. Excavations made through these rocky barriers have disclosed the old cement bed of the aqueducts intact below. This will give some idea of the antiquity of irrigation in the territory.

The recent Indians when discovered by the Spanish conquerors lived by farming and then as now their farming was made possible by the artificial storage and carriage of water. Their period may be said to begin with the time when the present ruins along the valley of the Rio Verde were efficient channels watering rich lands, and has been continued to the present day.

What uncivilized Aztecs and barbarian Indians were wise enough to do white settlers have been shrewd enough to improve upon. Recent as is the agricultural settlement of Arizona, owing to Indian wars now ceased, the Territory can yet present a good list of irrigation systems in successful and valuable operation. More than 400 miles of canals bring water to considerably more than 500,000 acres of agricultural land which is now under tilth in addition to 100,000 acres so favorably situated as to be quite independent of artificial water supply. This irrigable land is distributed over the several counties as shown in the following tabular statement which has been prepared by Mr. T. E. Farish of Phœnix, the Territorial Commissioner of Emigration.

| | Acres. |
|---|---|
| Apache County | 6,900 |
| Yavapai County | 40,360 |
| Gila County | 7,600 |
| Pinal County | 71,600 |
| Graham County | 47,000 |
| Maricopa County | 321,000 |
| Yuma County | 40,000 |
| Pima County | 7,500 |
| Cochise County | 23,500 |
| Mohave County | 1,000 |
| Total | 566,460 |

On a matter of such interesting moment particulars are not out of place, and it is on this account that these figures are examined with some detail.

*Pima County.*—This border county is one of the least explored in Arizona and, with the exception of scattered mines in the Quijotoa mountain district, settlement is restricted to a narrow north and south strip between the extreme eastern boundary and the Rio Santa Cruz. Yet notwithstanding the narrowness of this settled strip there are 7,500 acres under irrigation. In the immediate neighborhood of Tucson are thirty-six ditches which irrigate fully 3,000 acres in their 56 miles of extent. Some of these ditches have been in use since 1690 and three of the reservoirs date from the same year, namely El Cumoso, Missional, and Del Rey. Several ditches are now constructing, of which two are of considerable magnitude, one at Santa Cruz and the other near Tucson.

The extension of the irrigation system contemplates the addition of fully 2,000,000 acres to the agricultural resources of the county. This it is intended to effect principally by the construction of a dam or dams at a point 25 miles southeast of Tucson, which would bring at least 100,000 acres out of sandy idleness into rich fruition. A detailed survey has shown the confluent of the Rio Santa Cruz known as the Pantano Wash to be best and most economically available for irrigation supply by storing the freshets which come down the stream in both the summer and winter rainy seasons. The steady flow of water in this stream is so slight that it may be disregarded as an unimportant factor, reliance being placed entirely on the torrential flow of winter and summer to fill the storage basins. The first of the series of three dams recommended has been chosen at the point of meeting of the Cienega and Davidson's Cañons, some 23 miles southeast of Tucson. Here a dike of hard eruptive rock appears on the left bank, continues unbroken to the bed of the creek where it upholds the sands, and makes its surface reappearance on the right bank of the main channel. A second dike is found on the right bank of the river bed and there is reason to suppose that it joins the former. Even though the bed-rock be not continuous the dam would yet have two abutments and a central pier of solid rock. A dam constructed at this point would have a total length of 1,052 feet and a maximum height of 67.5 feet maintained for 200 feet of length while the remainder of the length would need only 35 feet of height. The plan calls for a secondary dam 150 feet long with an average height of 6 feet. These dams would back up the water in Cienega and Davidson's Cañons in two rectangular sheets, 63.92 acres of an average depth of 20.50 feet in Davidson's Cañon, 210 acres of an average depth of 26.47 feet in Cienega Cañon. The capacity of the reservoir would be 299,580,795 cubic feet. The objections to the plan are twofold: First, that no adequate provision can be made for the removal of sedimentary deposits which would tend to reduce the capacity of the reservoir and ditches; second, that the waters would cover the track of the Southern Pacific railroad for three-quarters of a mile.

The second site recommended for a dam is 5 miles south of this point at a narrow part of the cañon where the total length of the structure need be but 418 feet, the maximum height 43.43 feet, and the average height 40 feet. This would cover an area of 67.12 acres to an average depth of 22.37 feet with 65,391,298 cubic feet of water. This amount is so small that the reservoir would have slight value for irrigation directly. As a subsidiary work to the third collecting basin it is well nigh indispensable.

The third dam is indicated for a point 2 miles further down stream and 7 miles below the junction of the Cienega and Davidson's Cañons. A dam built at this point would require a length of 2,640 feet, exactly half a mile, its maximum height would be 73.96 feet and for 2,000 feet of its length it would average 70 feet. The contents of the basin thus created would be 752,169,384.8 cubic feet of water spread over 514.23 acres to an average depth of 33.53 feet. Such an amount of water, if subject to no replenishment, could not be discharged in less than a year through a ditch 12 feet wide by 4 deep and with a velocity of 29.42 feet the minute. The second dam is rendered necessary by the torrential violence of the stream at its semi-annual freshet and would serve to reduce its force of impact against which it would be scarcely possible to structurally strengthen the long dam. The upper reservoir would also subserve the useful purpose of a settling basin for the lower reservoir. It is calculated that the permanent flow of the Pantano would supply one-half of the amount lost by evaporation from the surface of the reservoir.

*Cochise County.*—In the report of the Emigration Commissioner this southeastern corner of the territory is credited with having 23,500 acres cultivated in dependence on irrigation ditches. The aqueduct systems are not large but make up the average by numbers. In an interesting report on the post gardens at Camp Huachuca, Maj. Julius H. Patzki, U. S. Army, surgeon of the post, notes that with the single exception of potatoes a good supply of vegetables is grown under a very moderate degree of irrigation in the four months April to July. These gardens are in Tanner's Cañon, 7 miles east of the post. This exception of potatoes deserves a particular mention to stimulate further inquiry or to lead to the institution of further experiments, because the head of this cañon has been widely heralded as the first and almost the only spot on the American continent where have been found specimens of this plant growing in a free and wild state, although it is known to be indigenous to this hemisphere. This interesting discovery which had been known to botanists for years was made in 1882 by J. G. Lemmon, a vendor of herbarium supplies.

Prof. Edward Lee Greene, of the University of California, and the leading authority on the botany of the Pacific Coast, thus writes to the point:

> "Two species of *Solanum* (potato) bearing tubers are common throughout southern Arizona and New Mexico. One (*S. jamesii*) belongs to the plains, the other (*S. fendleri*) to the mountains. The mountain species is the one which to me, in the days when I was familiar with both, looked most like our cultivated *S. tuberosum*. Both are nearly related to it, yet doubtless both are specifically distinct. Their tubers, though very small, are used by the Indians as food. Just which one of the austral wild tuber-bearing solanums is the parent of our cultivated varieties is a question which has baffled our best students of plant history and distribution for years past."

In Ramsay's Cañon near by the water supply is somewhat too precarious for gardening. At the mouth of Ash Cañon an attempt at irrigation from a well is made. On a few ranches west of the post, and extensively in the valleys of the Rio San Pedro and Barbacomori Creek, crops of fruit, vegetables, grain, and hay are produced, all under irrigation, for which the water supply is ample. In the San Simon Valley the total ditch system amounts to but 2 miles, and its use is confined to the alfalfa crop. The ditch system of the Sulphur Springs Valley amounts to but 4 miles and is mainly applied to small gardens. The aqueducts of the San Pedro Valley comprise more than 45 miles of conduits. The dams are temporary wing-dams carried away by almost every freshet, mere piles of brush and earth or bags of sand. In the Sulphur Springs Valley, containing some 38 ,000 acres, the water underlies the surface between 15 and 20 feet. Wells have been dug in many places, and their success is such as to encourage the expectation that the whole of the valley may be brought under cultivation by wells and motors utilizing the wind power. The same is true of the valleys of the San Simon on the east and the San Pedro on the west, whose waters to a large percentage flow underground. Dams interrupting this flow by a trench filled with concrete would avail to reclaim many thousands of acres without ditches and without loss by evaporation. Two points only in the San Pedro Valley exhibit advantageous sites for reservoirs. About 15 miles north of Benson, at the Nigger Ben place, a dam 350 feet long and 40 feet high could be made to store 278,784,000 cubic feet available for the irrigation of 3,000 acres. A mile and a half above Charleston and 26 miles south of Benson a dam 400 feet long and 60 feet high would retain more than 300,000,000 cubic feet. The great drawback which will seriously interfere with the value of these reservoirs is the large amount of evaporation, which is so great that only a small part of the water would be available for the early summer months when of course the maximum is needed.

*Pinal County.*—The irrigating system in this county, at present affecting 71,600 acres, depends on the Gila. It may utilize the San Pedro, and by wells and wind motors the subterranean flow of the Santa Cruz. Little has been attempted so far, except at Florence, where the lands are irrigated by a dozen separate canals or ditches. A. T. Colton, civil engineer, of Florence, in a succinct communication on the subject, notes that the Gila Valley, in the vicinity of Florence, contains about 750,000 acres capable of irrigation, of which 5,000 can be safely carried through a dry season by ditches, and the remainder might be irrigated from storage reservoirs. The same authority notes that the number of miner's inches (California standard) usually required for the irrigation of a quarter section of land in grain is 10 for one crop, for alfalfa 30, and for fruit 20. He explains that his calculation is based on a continuous flow of water. For example: A flow of 10 miner's inches is equal to 46,656,000 gallons on 160 acres in one year, or 291,600 gallons annually to the acre. This is equal to a rainfall of 10.8 inches, to which should be added 3.8 inches (the actual rainfall directly applicable to agriculture as observed in February, March, and April, 1889), making a total of 14.6 inches for one crop of grain, an amount considered ample. This water is to be applied to a crop of grain in three irrigations. New land will require about 50 per cent. more water for the first 2 years.

The existing systems of irrigating ditches have been tabulated by a committee acting under orders of the board of supervisors of the county, as here follows:

*Gila system.*

| Name. | Length. | Acres. | Name. | Length. | Acres. |
|---|---|---|---|---|---|
| *North bank.* | | | *South bank.* | | |
| | *Miles.* | | | *Miles.* | |
| Moore's | 3 | 300 | Brash | 4 | 400 |
| McClellan | 3 | 300 | Florence | 43 | 60,000 |
| Sharp | 3 | 160 | Montezuma | 6 | 1,000 |
| Stiles | 4 | 300 | Pat Holland | 7 | 1,000 |
| The Swiss | 2 | 200 | Alamo Amarilla | 7 | 1,000 |
| Shields | 2½ | 480 | Brady | 4 | 1,000 |
| Winkleman | 1½ | 480 | Adamsville | 4 | 1,000 |
| Brennaman & Co | 1¼ | 320 | White | 3 | 200 |
| | | | Walker & Dempsey | 3 | 300 |

*San Pedro system, west side.*

| Name. | Length. | Acres. | Name. | Length. | Acres. |
|---|---|---|---|---|---|
| | *Miles.* | | | *Miles.* | |
| Lattin | 1 | 80 | Bates | 1½ | 160 |
| Harrington | 1¾ | 480 | Pusch | 2 | 640 |
| Swingle | 2 | 480 | Dodson | 2 | 320 |
| Waterman No. 1 | 1½ | 320 | Cook | 1½ | 200 |
| Waterman No. 2 | 1½ | 320 | Brown | 1¼ | 160 |

The Florence Canal Company has in contemplation the building of storage reservoirs, of which one is approaching completion. It is situated 15 miles south of Florence and will have a capacity of 8,000,000,000 gallons, which it is certain will be replenished once a year and possibly twice.

The main addition contemplated to the irrigation facilities of the county depends on the impounding of the waters of the Gila at the narrows known as the Buttes, about 15 miles above Florence. At this point the bluffs are precipitous and the gorge is not more than 200 feet wide at its bottom. It appears that a dam 150 feet high will back the water about 20 miles with an average depth of 75 feet for the whole distance. Immediately above the Buttes the cañon of the river broadens, and at a distance of one-quarter of a mile it is as much as half a mile wide on the bottom, and for much of the entire distance it is a mile or more wide. The sides of the mountains surrounding this basin are broken by lateral cañons that add greatly to the contents. There can be no doubt of the water supply being sufficient to fill this reservoir, vast as it is, for a glance at the chart of isohyetal curves will at once show its dependence on areas of large precipitation.

*Graham County.*—As before, Mr. Farish is authority for the statement that 47,000 acres in this county are cultivated by means of irrigation. In the absence of more definite information it is believed that such ditch systems as exist are small and depend on water drawn by gravity from the ordinary flow of the Gila and on minor sources of supply. Acting Assistant Surgeon William Johnson at Fort Thomas in reporting on the post garden on the site of old Camp Goodwin, some 6 miles west of the fort, says that the supply of water is unlimited and is used just as needed and in such quantity as seems desirable. Mr. R. B. Tripp, of Eagle Pass, reports on the Pueblo Viejo Valley that there annually goes to waste down the flooded Gila water more than sufficient to supply the entire valley could it be stored. Concerning the same valley of Pueblo Viejo Mr. Edward D. Tuttle, of Safford, submits an able and interesting statement. The valley lying on both sides of the Gila contains 150,000 acres, of which 50,000 acres can be irrigated by ditches tapping the Gila and 10,000 more by storage reservoirs, the best results being promised by impounding the Gila. Irrigation is necessary more or less the whole year around; in general it must begin in February and continue until the middle of May for grain and into September for corn and fruit. Under the system now in use, which he characterizes as wasteful, 40 miner's inches are required for a quarter section in grain, but if the reservoir system prevailed 10 inches would be ample. Fruit land for the first and second years would require 40 inches and after that 20 inches would suffice. In general the black adobe soils require water twice as often as the loams.

Mr. Tuttle makes the following suggestions, which are worthy of attention as the views of a man practically acquainted with the situation:

"One general principle may be asserted. To run an irrigating ditch over a given territory a certain strength of stream must be maintained, varied by the fall and the absorbing capacity of the soil; the greater the fall and the less absorbent the soil the smaller the stream need be. If conducted to the point where the irrigation is to be applied in a pipe or cemented ditch, one-tenth of the present amount would suffice. The expense of this method will prevent its adoption in the cultivation of ordinary crops which do not yield much profit. However, should it be demonstrated that citrus fruits can be profitably grown here, irrigation projects of an expensive character can be carried out by private enterprise, as land will become very valuable, but I have yet to learn that a single orange tree has been set out here. If citrus fruits are to be grown at all it must be in the thermal belt on the mesas, and not on the colder bottom lands. Since the best fruit lands are those that are now above any water available for irrigation I have more faith in obtaining artesian water or pumping from wells than in irrigation under the reservoir system If Government will appropriate enough to test the possibility of obtaining artesian water more good can be accomplished with a small sum than in any other way."

Judge J. T. Fitzgerald, of Solomonsville, has prepared the following accurate statement of the existing canals in Graham County, with the length of each and the acreage under ditch. The Gila River is the common source of supply

| Name. | Length. | Acres. | Name. | Length. | Acres. |
|---|---|---|---|---|---|
| | *Miles.* | | | *Miles.* | |
| Brown | 3 | 1,200 | Oregon | 10 | 6,000 |
| San José | 6 | 1,000 | Bryce | 8 | 4,500 |
| Mejia | 4 | 600 | Nevada | 10 | 6,000 |
| Gonzales | 3 | 1,000 | Curtis | 6 | 3,600 |
| Michelena | 5 | 1,200 | McMurren | 6 | 1,400 |
| Montezuma | 6 | 3,600 | Maxey | 11 | 4,800 |
| Union | 15 | 10,000 | Thompson | 3 | 500 |
| Darby | 4 | 1,200 | Boon | 10 | 3.000 |
| Senobia Gonzales | 4 | 1,100 | Ward and Courtney | 6 | 1,600 |
| Central | 6 | 2,000 | | | |
| Graham | 8 | 2,700 | Total | | 64,000 |
| Smithville | 15 | 8,000 | | | |

There are about 90,000 acres in the Gila Valley which could be brought under cultivation by proper extension of the above canals.

*Gila County.*—In this mountainous county the estimate is made that 7,600 acres are cultivated in dependence on irrigating ditches. In the eastern part of the county within the San Carlos reservation there is an extent of arable land variously conjectured to amount to 200,000 or 300,000 acres. On this irrigation is carried on to a small extent by the Indian Bureau, and affects perhaps 2,500 acres. In the western half of the county there may be about 12,000 acres of arable and irrigable land in patches and small strips in the narrow valleys of Salt River and Tonto Creek, with a contracted area on Pinal Creek north of Globe. The few and small existing ditches are used to apply water to 800 acres. The board of supervisors of the county formally represents that it is a mining and grazing country, without agricultural possibilities, and protests against the proposed creation of a storage reservoir on Salt River and Tonto

Creek on the ground that it will in no wise benefit Gila County, within which it will lie, but on the contrary will destroy almost all the agricultural land of that county and will obliterate the only feasible location of a north and south railway to Globe, whose route has already been surveyed and tracks laid for 40 miles.

*Maricopa County.*—This central division of the Territory has 321,000 acres dependent on irrigation already in operation and of this amount about half is under crop. Of a total acreage aggregating 5,986,500 it has been computed after careful survey that 3,000,000 acres can be reclaimed by a judicious system of impounding the drainage and storm waters. The existing irrigation systems depend on the Gila and the Salt Rivers, as appears in the following tabular statements.

*Salt River system.*

| Name. | Length. | Name. | Length. |
|---|---|---|---|
| | *Miles.* | | *Miles.* |
| Arizona | 41 | Utah | 6 |
| Grand | 22 | Farmers | 5 |
| Maricopa | 14 | Highland | 22 |
| Salt River Valley | 18 | Dutch Ditch | 4 |
| San Francisco | 9 | Monterey | 4 |
| Tempe | 19 | Griffin | 3 |
| Mesa | 9 | | |

Upon these channels depend some 250,000 acres, of which 187,500 have been reclaimed and 125,000 are annually cultivated.

*Gila River system.*

| Name. | Length. | Acres. | Name. | Length. | Acres. |
|---|---|---|---|---|---|
| | *Miles.* | | | *Miles.* | |
| Buckeye | 30 | 20,000 | Gould & Bros | 8 | 3,000 |
| Gila River | 8 | 5,000 | Palmer | 22 | 12,000 |
| Enterprise | 12 | 6,000 | Citrus | 14 | 5,000 |

Under construction are the Monarch Ditch, 8 miles long, serving 2,000 acres; the Gila River Irrigation Company, with 12 miles completed, beginning at Black Butte, below the mouth of the Hassayampa, where it is proposed to build a dam 1,755 feet long and 75 feet high, and through a canal 75 miles long to serve 500,000 acres on the left bank as far as the line of Yuma County; the Gila Bend Canal Company has completed 22½ miles of a canal, which is to have a total length of 30 miles and serve 18,000 acres, and a 50-mile canal is now being excavated which is intended to develop 80,000 acres.

The Chamber of Commerce of the capital city, after examination of the several sources of water supply, has definitely determined to recommend that site which, as has been noted, has been the subject of a protest on the part of the board of supervisors of Gila County. The site is on Salt River, at a point some 400 yards below the junction of Tonto Creek, where the river flows into a box cañon with sides perpendicular for the first 100 feet and sloping above at an angle of 45°, the bed of the stream being just 200 feet wide. A dam 200 feet high erected at this spot would back the water up Salt River for 16 miles to its cañon through the Sierra Ancha. For 2 miles back from the dam the lake would be half a mile wide and 180 feet deep; the next 2½ miles would show a width of 2 miles and a depth of 140 feet; the next mile would contract to a quarter of a mile in width, with a depth of 130 feet, and then would come a stretch of 10½ miles, having a width of 2 miles and an average depth of 70 feet. To this should be added the arm of the lake, which would be created in Tonto Creek for 10 miles, with an average width of 1½ miles and 80 feet depth, and smaller arms in Pinto Creek, the Sallamay, and others. This dam would impound in all 103,058,040,800 cubic feet of water, thus constituting it the largest reservoir in the United States.

*Yavapai County.*—In 1889 the farmers of Yavapai County tilled 10,000 of the 40,360 acres in their limits covered by canals and ditches. In addition to dam sites utilized at Date Creek and Bill Williams' Fork, which are intended to reclaim 50,000 acres, the only systematic irrigation attempted in the county was in connection with the dam of the storage company at Walnut Grove, on the headwaters of the Hassayampa, which was primarily designed for hydraulic mining. This reservoir covered an area of 527½ acres, and received the drainage of about 500 square miles of territory, mostly of a mountainous character, the greater part of which consisted of bare granite rock, allowing a quick flow of water, resulting from melting snow and rainfall, to the receiving reservoir. The dam which closed the head of the cañon was 110 feet high, 135 feet thick at base, 12 feet thick, and 420 feet long on the top. Fourteen miles below this was a small service dam, 220 feet long and 44.5 feet high. On February 22, 1890, a flood of unprecedented violence, after 3 days of extremely heavy rain, completely destroyed this system of dams and suddenly poured down the gorge the contents of the reservoir, which had a storage capacity of 4,440,000,000 gallons.

It was the intention of the company before meeting with the disaster of last February, which intention will be carried out on the reconstruction of the works, to build a bedrock service dam some 38 miles below the storage reservoir for the purpose of raising water into a canal of 10 or 12 miles in length, constructed to carry water stored above out on the mesa between the Hassayampa and Agua Fria, than which there is no finer piece of land in the Territory. The river bed would be used as a conduit to the head of the canal. The necessary sub or irrigating ditches would be constructed to properly distribute the water to ranches taken under the main canal. It was also their intention to construct other dams on the tributaries above, forming other reservoirs, in order that about 30,000 miner's inches of water could be drawn off daily and utilized for irrigation purposes during the irrigation season.

One hundred miner's inches of water will irrigate about 160 acres of land, much less being required after the same land is seeded to a permanent crop or set in different fruits. Thirty thousand miner's inches would irrigate in the neighborhood of 50,000 acres by proper care.

The flow of the Hassayampa during the storm, which resulted so disastrously for the Walnut Grove Water Storage Company, was, on close calculation, 7,000 cubic feet per second. There are about 7½ gallons to the cubic foot, and about 17,500 gallons in 24 hours make a miner's inch. A flow in the river of 7,000 cubic feet per second would give a fraction over 4,500,000,000 gallons in 24 hours.

*Apache County.*—The Commissioner of Emigration reports 6,900 acres under irrigating ditches and cultivation in practice upon all the land available. At Woodruff, on Silver Creek, the Mormons, who have there made a stake, have completed a reservoir which they operate with marked success, as is clearly proved by the thrift of the communities dependent on it. The distributing ditch is about 700 yards long before subdivision and supplies 3 miles of laterals which irrigate about 1,000 acres. The dam was washed away last spring and was not repaired in time to make the system available during this year. Two miles above St. John's there is a small reservoir which covers 50 acres 12 feet deep and supplies water for some 3,000 acres in the neighborhood of the town. A small reservoir at Coneto has been in use for 10 years to irrigate 250 acres. At Snowflake, on Silver Creek, another small reservoir covers 50 acres to an average depth of 4½ feet.

The board of supervisors in reporting on the possible development of irrigation in the county confined its detailed examination to the valley of the Colorado Chiquito, between Springerville and St. John's, and reports six sites available for storage reservoirs. The first is 25 miles above St. John's, and is fed by a living stream, which would cover 600 acres 12 feet deep by building a bank 300 feet long and 25 feet high. The second site is 22 miles above St. John's, on Coyote Wash, where a dam 495 feet long and 100 feet high would cover 2,000 acres with 12 feet of water. This system could be utilized upon 20,000 acres of good land near St. John's in addition to 1 500 acres within the Wash. The third site is on the Colorado Chiquito, 16 miles above St. John's, at a point where a 20-foot bank 900 feet long would cover 700 acres to a depth of 8 feet. The fourth site is at Salado Springs, where a dam 70 feet high and 600 feet long would impound sufficient water to irrigate 60,000 acres.

At Padre's Lake, a mile above St. John's, a storage basin, dependent on the spring thaws, could be constructed by an embankment only 10 feet high and 1,000 feet long, which would cover 100 acres 6 feet deep. The last of the series is recommended for the mouth of the Zuñi River, where a dam 80 feet high and 700 feet long would cover 7,000 acres to an average depth of 35 feet, an amount which would suffice to keep 125,000 acres well irrigated.

*Mohave County.*—There is little agricultural land in this county, and its uniform elevation above the Colorado militates to preclude irrigation except as applied to small pockets of loam in expansions of the cañon of the river. Mr. Farish credits it with 1,000 acres of irrigated land, all under cultivation.

This estimate is doubled by Mr. C. M. Funston of Kingman. His report is that irrigation is practiced in but one section of the county and there only in a crude way. The ditches are maintained solely by individual effort and cover probably 2,000 acres.

The reason for this state of affairs, in his opinion, is due to the fact that there are no public lands in the county; at least none have been surveyed by the Government and thus thrown open to selection. He estimates that there are 200,000 acres of irrigable land in the county, which will be rapidly taken up as soon as it comes upon the market.

*Yuma County.*—Of 40,000 acres under existing ditches this county is credited with having cropped but 6,000 acres during the season of 1889, but it must be kept in mind that irrigation in the Lower Gila Valley is yet in its infancy. Of the canals now operated only one is completed according to the designs of the engineer, and the remainder are put to so much use as is possible in their incomplete condition. They all draw their supply from the Gila and are restricted in their sphere of utility to the bottom lands of that valley. The following table will give interesting figures concerning the most important ditch systems now in operation in whole or in part. The plans of the projectors, it should be said, contemplate the extension of some of these canals to compass a total length of 241 miles and reclaim 267,000 acres:

| Name. | Length. | Acres. | Name | Length. | Acres. |
|---|---|---|---|---|---|
| | *Miles.* | | | *Miles.* | |
| Mohawk | 35 | 40,000 | Contrera | 7 | 2,000 |
| Redondo | 5 | 1,500 | Saunders | 10 | 4,000 |
| Farmers | 13 | 10,000 | Araby | 8½ | 2,000 |
| South Gila | 22 | 12,000 | Antelope | 7 | 2,500 |
| Purdy | 10 | 7,000 | Toltec | 3 | .......... |

A canal, now disused, was operated in the northern part of the county in the sixties, deriving its supply from the Colorado near Parker in the Indian reservation. The head gate was situated on the arc of a basin formed by a reef of solid rock reaching half way across the river and so subject to eddy currents that no sediment is ever deposited. A tunnel several hundred feet long was dug through a hill and thus the canal was led to the foot of the mesa and so to a valley 5 or 6 miles below. It operated well until the tunnel caved in and shut off the supply. The works still remain and could be put to use by a little clearing in the dry bed of the canal and by facing the water-way of the tunnel to prevent that scouring of the soft stratum which caused the cave.

Two great systems of irrigation are proposed by the residents of the county, one on the Gila, the other on the Colorado. The Gila system looks to the building of a dam at Oatman's Flat, about 100 miles northeast of Yuma and just outside the county boundary. At this point the river cutting the southerly spur of the Big Horn Mountains exposes solid bluffs of dolomitic limestone from 110 to 125 feet high at a distance of 1,595 feet from each other. Here it is proposed to build a dam 100 feet high, resting its ends on these solid walls of rock. The water thus stored will back up a cañon but half a mile wide for a distance of a mile and a half up stream; then it will occupy Oatman's Flat, 3 miles long by a mile and a half wide; then, after narrowing to three-quarters of a mile, the basin will expand to occupy Cottonwood Flat, 8 miles long by 4½ wide, and after another constriction Gila Bend Flat for 8½ miles. The area covered by water when it is just at the top of the dam is computed to be 48.4 square miles, with an available depth of 35 feet after allowing for 7½ feet of evaporation. This will store 47,227,009,600 cubic feet of water, which will prove ample to allow the daily withdrawal of 151,385 miner's inches for 6 months, an amount sufficient to irrigate more than 600,000 acres.

The proposed Colorado Canal is projected to head at a point some 28 miles above Yuma. Here the river channel is cleft by Stevenson's Island, which acts as a dam to the waters and causes a rapid which is measurable as a fall of 4 feet in 600 feet of flow. This provision of nature it is designed to increase by art. A dam and lock will be erected at the island, which will not interfere with the traffic of the river, it being a navigable stream for 650 miles to the mouth of the Rio Virgen. This lock will raise the water 12 feet above the low-water stage, both to enable the water to be spread over more of the mesa land and also to secure in the lock the functions of a settling basin in order that the heavier sediment may be kept out of the canal. From the lock at Stevenson's Island the canal with a minimum width of 50 feet will be carried above the bottom lands and flumed across the Gila with the possibility of extension into the State of Sonora. The amount of land to be reclaimed by this canal is figured at 175,000 acres, thus apportioned: 25,000 acres in the upper angle of the Gila and Colorado; bottom and valley lands between the Gila and the Mexican boundary, 70,000 acres; and adjoining mesa land similarly situated, 80,000 acres. This canal, affecting as it does land within the scope of the Gila canals, will prove no rival, but a complement to that system, inasmuch as the Colorado high water comes at the period of minimum supply of the Gila.

In every dam to be built provision should be made for the removal of sediment which will tend to fill up the storage basins, a tendency which will develop with remarkable rapidity. The causes which have been of the utmost value in preparing a soil worthy of being irrigated will exert an influence prejudicial to the practical application of the measures of irrigation. The streams will not lose their burden of silt and detritus by being diverted into storage basins, but they will deposit it within the basins, where the waters are held practically motionless. It would be extremely unwise, therefore, to construct reservoirs which are not provided with ground sluices sufficient in number and so placed as to cover the whole bottom of the reservoir in their prisms of scouring action.

### RECAPITULATION.

Thus in brief review have been presented the operations of irrigation now practiced in Arizona, and a sketch of such extensions of the principle as seem so feasible to those most intimately concerned that they feel justified in the hope that they will be put into execution. Fuller accounts of these matters will undoubtedly be presented by those whose duty it is to handle the engineering and economic problems involved. This brief review, however, is eminently pertinent in the present record, because it shows that the phenomena which constitute the proper objects of the meteorologist's study have been appreciated by the agricultural community and have been thus satisfactorily corroborated by removal from the abstraction of mere theory into the domain of practice and daily use.

It may not be out of place to present a final summation of the results attained by the meteorological student in the investigation of that part of the arid lands comprehended within the territorial limits of Arizona. They are these:

(1) Twice each year there occurs sufficient aqueous precipitation in Arizona to reclaim every acre of land worthy of such reclamation.

(2) The coefficient of evaporation though absolutely high yet is relatively so small in comparison with the total fluid contents of the actual and projected storage basins that it may be economically disregarded as a vanishing quantity.

(3) A measureless amount of foot-pounds of available power is daily going to waste in the winds which blow over the land. This power rendered efficient by wind motors will suffice to utilize the large subterranean rivers which are known to immediately underlie large areas of rich land.

With the presentation and the proof of these propositions which are the only components of the reclamation problem properly within the sphere of its activity the Signal Service is satisfied to turn its data over to others whose duty it shall be to apply to varying economic conditions the conclusions herein reached.

# APPENDIX No. 7.

## *LIST OF STATIONS IN ARIZONA FOR WHICH METEOROLOGICAL DATA ARE GIVEN.*

The names of the stations have been arranged alphabetically under their several counties, commencing at the northwestern portion of the Territory.

Latitudes and longitudes, as given, are not in all cases astronomically correct. Those which have not been accurately determined by reliable surveys have been corrected by reference to the latest standard maps.

Elevations, likewise, are not always given with accuracy. All those in which any reason for doubt existed have been referred to the nearest datum point upon some trustworthy system of contours or determined elevation.

Broken records are indicated by an asterisk (*) in the column "Length of Record". The missing period may be ascertained by an inspection of the printed records as they appear in Appendices Nos. 8 and 9.

References: S. S., second order stations of the Signal Service; V. O., voluntary station; M. D., stations of the Medical Department of the Army reporting through the Surgeon-General; R. R., station of the Southern Pacific Railroad.

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*List of stations in Arizona for which meteorological data are given.*

| Class. | County and station. | Latitude. | Longitude. | Elevation above sea-level. | Record. | | | | T. or R. missing. | Authority. |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | Length. | | From— | To (inclusive)— | | |
| | *Mohave.* | ° ′ | ° ′ | *Feet.* | *Yrs.* | *Mo.* | | | | |
| V. O... | Chloride | | | 4,201 | 0 | 10 | July, 1889 | May, 1890 | | H. P. Ewing. |
| V. O... | Fort Mohave | 35 02 | 114 36 | 604 | 25 | 11 | July, 1859 | Sept., 1890 | | U. S. post hospital. |
| V. O... | Signal | | | 1,500 | 1 | 5 | May, 1889 | do | | William Koshland. |
| M. D.. | Camp Beal's Spring | 35 20 | 114 05 | 2,500 | 1 | 0 | Apr., 1873 | Mar., 1874 | | U. S. post hospital. |
| | *Yavapai.* | | | | | | | | | |
| M. D.. | Camp Date Creek | 34 18 | 112 40 | 3,726 | 6 | 3* | May, 1867 | July, 1873 | | U. S. post hospital. |
| M. D.. | Camp Hualpai | 35 10 | 113 50 | 5,322 | 3 | 2* | Jan., 1870 | June, 1873 | | Do. |
| M. D.. | Camp Willow Grove | 35 10 | 113 50 | 4,170 | 1 | 7 | Feb., 1868 | Sept., 1869 | | Do. |
| S. S... | Prescott (Whipple Barracks). | 34 33 | 112 28 | 5,389 | 23 | 11 | Jan., 1865 | Sept., 1890 | | U. S. post hospital and Signal Service. |
| V. O... | Williams | | | 6,727 | 1 | 8 | May, 1888 | Jan., 1890 | T. | J. T. Ryan. |
| V. O... | Flagstaff | | | 6,862 | 1 | 5* | July, 1888 | Mar., 1890 | | Bramen & Co., Mrs. F. B. Jacobs, and M. J. Riorden. |
| V. O... | Banghart's (Chino) | | | 5,047 | 1 | 0* | do | Aug., 1890 | | George Banghart. |
| V. O... | Cottonwood | | | 4,170 | 0 | 8 | July, 1889 | Sept., 1890 | T. | Thomas Carroll. |
| S. S... | Fort Verde | 34 32 | 111 47 | 3,160 | 22 | 0* | Nov., 1866 | Sept., 1890 | | Signal Service and U. S. post hospital. |
| V. O... | Strawberry | | | 5,400 | 1 | 3 | May, 1889 | do | | L. P. Nash. |
| V. O... | Antelope Valley | 34 18 | 112 42 | 4,500 | 1 | 8 | July, 1888 | July, 1890 | T. | Mrs. J. H. Hamilton. |
| V. O... | Walnut Grove | | | | 1 | 3 | May, 1889 | Sept., 1890 | T. | T. B. Carter. |
| V. O... | Payson | | | | 0 | 11 | July, 1889 | June, 1890 | T. | Minnie Thompson. |
| V. O... | Tip Top | | | 2,650 | 1 | 4 | June, 1889 | Sept., 1890 | T. | F. E. Wager. |
| M. D.. | Camp McPherson | 34 45 | 112 18 | 3,726 | 3 | 8 | May, 1867 | Dec., 1870 | | U. S. post hospital. |
| V. O... | Ash Creek | | | | 1 | 1 | Aug., 1889 | Aug., 1890 | T. | John H. Hudson. |
| | *Apache.* | | | | | | | | | |
| V. O... | Winslow | | | 4,825 | 1 | 6 | June, 1888 | Dec., 1889 | | L. W. Roberts, Chas. J. Dillon, C. B. Yost. |
| V. O... | Holbrook | | | 5,047 | 3 | 10 | Dec., 1886 | Sept., 1890 | | David Rope. |
| V. O... | Wood Canyon | | | | | 10* | Sept., 1889 | Sept., 1890 | T. | T. D. Bridger. |

* Record broken.

*List of stations in Arizona for which meteorological data are given*—Continued.

| Class. | County and station. | Latitude. | Longitude. | Elevation above sea-level. | Record. |  |  |  | T. or R. missing. | Authority. |
|---|---|---|---|---|---|---|---|---|---|---|
|  |  |  |  |  | Length. |  | From— | To (inclusive—) |  |  |
|  | *Apache*—Cont'd. | ° ′ | ° ′ | *Feet.* | *Yrs.* | *Mo.* |  |  |  |  |
| V. O | Show Low |  |  | 6,000 | 1 | 2 | Aug. 1889 | Sept., 1890 |  | George M. Adams. |
| V. O | Cooley's Spring |  |  | 6,700 | 1 | 0 | July, 1889 | do |  | C. E. Cooley. |
| S. S | Fort Apache | 33 48 | 109 57 | 5,050 | 18 | 10 | Nov., 1871 | do |  | Signal Service and U. S. post hospital. |
| V. O | Fort Defiance | 35 43 | 109 10 | 6,500 | 9 | 2* | Dec., 1851 | Nov., 1863 |  | U. S. post hospital. |
|  | *Yuma.* |  |  |  |  |  |  |  |  |  |
| M. D | Camp Colorado | 34 10 | 114 15 |  | 1 | 2 | Jan., 1869 | Feb., 1871 |  | U. S. post hospital. |
| S. S | Stanwix | 32 57 | 113 21 | 567 | 2 | 11 | Nov., 1875 | Nov., 1877 |  | Signal Service. |
| S. S | Yuma | 32 44 | 114 36 | 141 | 14 | 11 | Oct., 1875 | Sept., 1890 |  | Do. |
| R. R | Texas Hill |  |  | 355 | 11 | 0* | July, 1879 | do |  | Pacific Rwy. system. |
|  | *Maricopa.* |  |  |  |  |  |  |  |  |  |
| V. O | New River |  |  | 1,500 | 1 | 1* | Mar., 1889 | Sept., 1890 |  | J. F. Singleton. |
| V. O | Peoria |  |  | 1,000 | 1 | 1* | Jan., 1889 | Jan., 1890 |  | S. H. Campbell. |
| S. S | Fort McDowell | 33 38 | 111 38 | 1,250 | 23 | 10* | Sept., 1866* | Sept., 1890 |  | Signal Service and U. S. post hospital. |
| V. O | Buckeye |  |  |  | 0 | 6 | Aug., 1889 | May, 1890 | T. | B. W. E. Hurley. |
| S. S | Phœnix | 33 23 | 112 00 | 1,068 | 12 | 9 | Feb., 1876 | do |  | Signal Service. |
| S. S | Burkes | 32 58 | 113 16 |  | 3 | 0 | Dec., 1877 | Nov., 1880 |  | Do. |
| V. O | Gila Bend |  |  | 735 | 1 | 3 | July, 1889 | Sept., 1890 |  | Daniel Murphy. |
| S. S | Wickenburg | 33 56 | 112 42 | 1,400 | 8 | 1* | Nov., 1875 | Jan., 1886 |  | Signal Service. |
| V. O | Arizona Canal Co's Dam (near McDowell). |  |  | 1,150 | 1 | 1 | Aug., 1889 | Sept., 1890 |  | Cortez Cox. |
| V. O | Tempe |  |  | 1,100 | 0 | 9* | Oct., 1889 | Oct., 1890 |  | C. W. Miller. |
|  | *Gila.* |  |  |  |  |  |  |  |  |  |
| V. O | Globe | 33 26 | 110 45 |  | 1 | 4* | July, 1888 | Oct., 1889 |  | J. H. Hamill. |
| M. D | Camp Reno | 34 45 | 112 18 | 3,726 | 1 | 5* | Feb., 1868 | Eeb., 1870 |  | U. S. post hospital. |
| S. S | San Carlos | 33 12 | 110 27 | 3,456 | 9 | 3* | June, 1881 | Sept., 1890 |  | Signal Service. |
|  | *Pinal.* |  |  |  |  |  |  |  |  |  |
| M. D | Breckenridge (Old Camp Grant). | 32 48 | 110 36 | 3,800 | 6 | 10* | Dec., 1860 | Dec., 1872 | R. | U. S. post hospital. |
| S. S | Maricopa | 33 05 | 112 00 | 1,190 | 13 | 8 | Nov., 1875 | Sept., 1890 |  | Signal Service and Pacific Rwy. system. |
| V. O | Silver King |  |  |  | 0 | 9 | July, 1889 | Mar., 1890 |  | T. S. Collins. |
| S. S | Florence | 33 03 | 111 20 | 1,553 | 8 | 5 | Nov., 1875 | Sept., 1890 |  | Signal Service, A. T. Colton. |
| R. R | Casa Grande |  |  | 1,398 | 9 | 4* | Oct., 1880 | do |  | Pacific Rwy. system. |
| V. O | Dudleyville |  |  |  | 1 | 2 | July, 1889 | do | T. | G. F. Cook. |
| V. O | Red Rock |  |  | 1,867 | 0 | 11 | do | June, 1890 |  | W. A. Langham. |
| V. O | Willow Springs |  |  |  | 1 | 5 | May, 1888 | Feb., 1890 | T. | F. A. Chamberlain. |
|  | *Graham.* |  |  |  |  |  |  |  |  |  |
| S. S | Fort Thomas | 33 04 | 109 51 | 2,700 | 10 | 6 | April, 1880 | Sept., 1890 |  | Signal Service and U. S. post hospital. |
| M. D | Camp Goodwin | 33 05 | 110 00 | 2,650 | 3 | 11* | Jan., 1866 | May, 1870 |  | U. S. post hospital. |
| V. O | Clifton (Oro) |  |  |  | 0 | 10 | Sept., 1889 | June, 1890 | T. | George W. Wells. |
| V. O | Cedar Springs |  |  | 4,900 | 1 | 4* | May, 1888 | Nov., 1889 | T. | B. E. Norton. |
| V. O | Eagle Pass (Curtis) |  |  | 4,800 | 2 | 0* | do | Sept., 1890 |  | Dr. R. B. Tripp. |
| S. S | Fort Grant | 32 36 | 109 53 | 4,860 | 17 | 2* | Jan., 1873 | do |  | Signal Service and U. S. post hospital. |
|  | *Pima.* |  |  |  |  |  |  |  |  |  |
| V. O | American Flag |  |  |  | 0 | 10 | July, 1889 | Apr., 1890 | T. | I. H. Shields. |
| S. S | Fort Lowell | 32 16 | 110 47 | 2,400 | 19 | 5* | Nov., 1866 | Sept., 1890 |  | Signal Service and U. S. post hospital. |
| M. D | Fort Buchanan | 31 40 | 110 55 | 5,330 | 3 | 11 | Aug., 1857 | June, 1861 |  | U. S. post hospital. |
| V. O | Calabasas |  |  |  | 1 | 0 | June, 1889 | June, 1890 | T. | E. K. Sykes. |
| V. O | Crittenden |  |  | 4,172 | 0 | 8* | July, 1889 | Sept., 1890 | T. | E Vanderlip. |
| M. D | Camp Crittenden | 31 34 | 110 39 | 2,000 | 4 | 10 | Apr., 1868 | Jan., 1873 |  | U. S. post hospital. |

* Record broken.

*List of stations in Arizona for which meterological data are given*—Continued.

| Class. | County and station. | Latitude. | Longitude. | Elevation above sea-level. | Record. | | | T. or R. missing. | Authority. |
|---|---|---|---|---|---|---|---|---|---|
| | | | | | Length. | From— | To (inclusive)— | | |
| | *Pima*—Continued. | ° ′ | ° ′ | *Feet.* | *Yrs. Mo.* | | | | |
| V. O .. | Lochiel | | | | 1 11* | June, 1888 | Sept., 1890 | | San Rafael Cattle Company, by Mrs. Cameron. |
| R. R .. | Pantano | 31 47 | 110 41 | 3,538 | 9 9* | Oct., 1880 | June, 1890 | | Pacific Rwy. system. |
| S. S ... | Tucson | 32 14 | 110 54 | 2,404 | 14 10 | Nov., 1875 | Sept., 1890 | | Signal Service, Pacific Rwy. system, and E. L. Wetmore. |
| | *Cochise.* | | | | | | | | |
| S. S ... | Willcox | 32 20 | 109 42 | 4,164 | 9 9* | Oct., 1880 | Sept., 1890 | | Signal Service and Pacific Rwy. system. |
| M. D .. | Camp Wallen | 31 40 | 110 50 | 3,000 | 2 10* | Nov., 1866 | Sept., 1869 | | U. S. post hospital. |
| V. O .. | Ash Canyon | 31 23 | 110 12 | | 1 2* | Aug., 1888 | Sept., 1890 | | Jno. S. Robins. |
| V. O .. | Ash Spring | | | 5,500 | 1 1 | Sept., 1889 | ....do | T. | J. D. Kinnear. |
| R. R .. | Benson | 32 00 | 110 22 | 3,580 | 9 10 | Oct., 1880 | ....do | | Pacific Rwy. system. |
| V. O .. | Bisbee | 31 28 | 109 55 | 5,298 | 1 2 | Aug., 1889 | ....do | T. | Rev. J. G. Pritchard. |
| S. S ... | Fort Bowie | 32 12 | 109 20 | 4,781 | 23 2 | Aug., 1867 | ....do | | Signal Service and U. S. post hospital. |
| V. O .. | Dos Cabezas | | | 5,450 | 0 10 | Sept., 1889 | ....do | T. | T. C. Bain. |
| V. O .. | Dragoon | | | 5,436 | 0 9 | ....do | ....do | T. | Jno. W. Graham. |
| V. O .. | Fairbank (near) | | | 3,850 | 1 3 | July, 1889 | Sept., 1890 | | E. W. Perkins. |
| M. D .. | Fort Huachuca | 31 20 | 109 20 | 4,785 | 4 8 | Jan., 1886 | ....do | | U. S. post hospital. |
| V. O .. | Huachuca | 31 25 | 110 10 | 5,000 | 2 0 | June, 1888 | ....do | | J. W. Stump. |
| R. R .. | San Simon | 32 18 | 109 10 | 3,611 | 8 5* | Dec., 1881 | ....do | | Pacific Rwy. system. |
| V. O .. | Teviston | | | 3,846 | 2 4 | June, 1888 | ....do | T. | Miss Belle Tevis and Miss Mary Tevis. |
| V. O .. | Tombstone | | | | 0 10* | Apr., 1889 | ....do | | S. C. Bagg. |
| V. O .. | Chiricahua Mt's | | | 7,400 | 1 0 | Sept., 1889 | Aug., 1800 | T. | D. D. Ross. |
| V. O .. | Walnut Ranch | 31 45 | 109 15 | 5,600 | 1 0 | Nov., 1889 | Oct., 1890 | | F. W. Heyne. |

* Record broken.

# APPENDIX No. 8.

## *MONTHLY AND ANNUAL PRECIPITATION AT SEVENTY-FOUR STATIONS IN ARIZONA.*

**Interpolated values are entered in brackets [ ]. As a rule interpolations have been made from the Monthly Weather Review Charts, which contain data from all available sources and thus afford facilities for a very close approximation to the actual conditions which existed during the interpolated periods.**

**Reference: Capital T indicates a trace of precipition. * Data following asterisk, inserted in the revise and were not available when charts were made and text written, nor are the means in the tables changed.**

### AMERICAN FLAG, ARIZ.

| Year. | Jan. | Feb. | Mar. | Apr. | May. | June. | July. | Aug. | Sept. | Oct. | Nov. | Dec. | Annual. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1889 | ...... | ...... | ...... | ...... | ...... | ...... | 0.44 | 3.16 | 3.15 | 0.50 | 0.80 | 0.28 | ...... |
| 1890 | 2.70 | 2.60 | 1.80 | 0.57 | [0.00] | [0.00] | ...... | ...... | ...... | ...... | ...... | ...... | ...... |
| Means | ...... | ...... | ...... | ...... | ...... | ...... | ...... | ...... | ...... | ...... | ...... | ...... | 16.00 |

### ASH SPRINGS, ARIZ.

| Year. | Jan. | Feb. | Mar. | Apr. | May. | June. | July. | Aug. | Sept. | Oct. | Nov. | Dec. | Annual. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1889 | ...... | ...... | ...... | ...... | ...... | ...... | ...... | ...... | 1.25 | 0.63 | 0.15 | 1.13 | ...... |
| 1890 | 2.13 | 0.53 | 0.17 | 0.72 | 0.00 | 0.26 | 1.57 | 3.48 | 2.46 | ...... | ...... | ...... | ...... |
| Means | ...... | ...... | ...... | ...... | ...... | ...... | ...... | ...... | ...... | ...... | ...... | ...... | 12.62 |

### ANTELOPE, ARIZ.

| Year. | Jan. | Feb. | Mar. | Apr. | May. | June. | July. | Aug. | Sept. | Oct. | Nov. | Dec. | Annual. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1888 | ...... | ...... | ...... | ...... | ...... | ...... | 2.14 | 0.34 | 0.10 | 2.71 | 2.53 | 2.95 | ...... |
| 1889 | 1.93 | 0.64 | 3.14 | 0.00 | 0.00 | 0.00 | 1.67 | 2.29 | [3.00] | 2.35 | 0.13 | 5.86 | [21.01] |
| 1890 | 1.83 | 3.68 | 3.10 | 0.00 | 0.00 | T | 2.06 | *7.80 | 0.00 | 2.02 | 2.70 | 4.34 | 27.53 |
| Means | 1.93 | 2.16 | 3.14 | 0.00 | 0.00 | T | 1.90 | 1.32 | 1.55 | 2.53 | 1.33 | 4.40 | 20.26 |

### APACHE, FORT, ARIZ.

| Year. | Jan. | Feb. | Mar. | Apr. | May. | June. | July. | Aug. | Sept. | Oct. | Nov. | Dec. | Annual. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1876 | 0.92 | 1.72 | 2.02 | 0.08 | 0.26 | 1.02 | 5.20 | 2.52 | 2.00 | 2.44 | 1.34 | 0.22 | 19.74 |
| 1877 | 0.36 | 0.94 | 0.72 | 0.96 | 1.15 | 0.00 | 3.11 | 1.20 | 0.99 | 0.81 | 0.19 | 2.07 | 12.50 |
| 1878 | 0.18 | 1.35 | 2.41 | 1.77 | 0.18 | 0.79 | 8.76 | 9.33 | 0.76 | 0.00 | 1.94 | 1.14 | 28.61 |
| 1879 | 1.89 | 1.17 | 0.03 | 0.12 | 0.00 | 0.05 | 3.92 | 3.06 | 1.52 | 2.64 | 1.77 | 2.41 | 18.58 |
| 1880 | 1.31 | 0.95 | 0.80 | 0.46 | 0.00 | 0.46 | 5.83 | 1.44 | 0.55 | 0.56 | 0.03 | 2.38 | 14.77 |
| 1881 | 0.20 | 1.17 | 2.45 | 1.53 | 0.35 | T | 5.63 | 8.31 | 5.41 | 4.68 | 0.85 | 0.54 | 31.12 |
| 1882 | 2.82 | 2.85 | 1.09 | 0.91 | 0.94 | 3.27 | 4.79 | 7.36 | 1.02 | T | 2.34 | 0.23 | 27.62 |
| 1883 | 0.85 | 2.46 | 2.03 | 0.22 | 0.86 | 0.02 | 5.46 | 4.26 | 0.60 | 1.39 | 0.02 | 3.48 | 21.65 |
| 1884 | 0.68 | 3.43 | 4.44 | 1.67 | 1.31 | 2.35 | 0.14 | 5.59 | 1.50 | 2.02 | 0.82 | 5.52 | 29.47 |
| 1885 | 0.52 | 1.00 | 2.05 | 0.52 | 1.12 | 0.82 | 2.60 | 3.16 | 0.44 | 0.38 | 1.56 | 1.41 | 15.58 |
| 1886 | 3.90 | 2.73 | 1.06 | 0.91 | 0.00 | 0.19 | 1.90 | 4.75 | 3.16 | 1.66 | 0.56 | 0.24 | 21.06 |
| 1887 | 0.59 | 2.16 | 0.04 | 0.81 | 0.15 | 1.70 | 3.29 | 3.92 | 2.23 | 0.55 | 1.83 | 0.57 | 17.84 |
| 1888 | 1.42 | 1.83 | 2.92 | 0.71 | 0.71 | T | 3.24 | [1.00] | 0.32 | 1.23 | 2.63 | 2.88 | [18.89] |
| 1889 | 2.24 | 0.88 | 1.85 | 0.47 | 0.00 | 0.11 | 2.67 | 2.87 | 1.02 | 0.46 | 0.55 | 3.98 | 17.10 |
| 1890 | 2.26 | 2.40 | 0.82 | 1.39 | 0.00 | 0.00 | 5.00 | 4.44 | 2.37 | *2.17 | 2.85 | 3.02 | 26.72 |
| Means | 1.34 | 1.80 | 1.65 | 0.84 | 0.47 | 0.72 | 4.04 | 4.20 | 1.54 | 1.34 | 1.17 | 1.93 | 21.04 |

*Monthly and annual precipitation at seventy-four stations in Arizona*—Continued.

### ASH CAÑON, ARIZ.

| Year. | Jan. | Feb. | Mar. | Apr. | May. | June. | July. | Aug. | Sept. | Oct. | Nov. | Dec. | Annual. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1888 | ...... | ...... | ...... | ...... | ...... | ...... | ...... | 3.47 | 1.07 | 1.03 | 4.50 | 3.60 | ...... |
| 1889 | 1.80 | ...... | ...... | ...... | ...... | 0.26 | 4.42 | 0.20 | 4.35 | 2.30 | ...... | ...... | ...... |
| 1890 | ...... | ...... | ...... | ...... | ...... | ...... | 4.48 | 5.79 | 2.04 | ...... | ...... | *3.78 | ...... |
| Means | ...... | ...... | ...... | ...... | ...... | ...... | 4.45 | 3.15 | 2.49 | 1.66 | ...... | ...... | ...... |

### ASH CREEK, ARIZ.

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1889 | ...... | ...... | ...... | ...... | ...... | ...... | ...... | 0.47 | 0.65 | 1.89 | 0.60 | 10.22 | ...... |
| 1890 | 0.32 | 0.28 | 2.40 | 0.06 | T | 0.01 | 3.30 | 1.40 | ...... | ...... | ...... | ...... | ...... |
| Means | ...... | ...... | ...... | ...... | ...... | ...... | ...... | 0.94 | ...... | ...... | ...... | ...... | 20.67 |

### BANGHART'S (CHINO P. O.), ARIZ.

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1888 | ...... | ...... | ...... | ...... | ...... | ...... | 1.60 | ...... | ...... | ...... | ...... | 3.02 | ...... |
| 1889 | ...... | ...... | ...... | ...... | ...... | ...... | 5.50 | 2.40 | 0.40 | 0.90 | [0.40] | 4.35 | ...... |
| 1890 | [2.00] | 1.00 | 6.50 | 2.50 | 0.00 | 0.00 | [0.00] | 3.90 | *0.55 | 2.00 | 0.70 | ...... | ...... |
| Means | ...... | ...... | ...... | ...... | ...... | ...... | 3.55 | 3.15 | ...... | ...... | ...... | 3.68 | 24.08 |

### BENSON, ARIZ.

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1880 | ...... | ...... | ...... | ...... | ...... | ...... | ...... | ...... | ...... | 0.00 | 0.00 | [1.50] | ...... |
| 1881 | 0.00 | 0.00 | 0.75 | 0.00 | 0.00 | 0.02 | 2.17 | 4.33 | 0.99 | 0.34 | 0.00 | 0.00 | 8.60 |
| 1882 | 0.40 | 1.20 | 0.00 | 0.00 | 0.00 | 0.86 | 2.00 | 3.58 | 0.65 | 0.00 | 0.80 | 0.15 | 9.64 |
| 1883 | 0.65 | 0.63 | 2.08 | 0.00 | 0.42 | 0.16 | 2.97 | 2.78 | 0.10 | 0.21 | 0.07 | 0.50 | 10.57 |
| 1884 | 0.20 | 0.63 | 1.20 | T | 0.00 | 0.00 | 0.70 | 0.27 | 0.30 | 2.89 | T | 2.50 | 8.69 |
| 1885 | 0.05 | 0.95 | 0.07 | 0.00 | 0.00 | 0.75 | 0.58 | 1.44 | 0.14 | 0.00 | 0.09 | 0.17 | 4.24 |
| 1886 | 0.79 | 0.67 | 0.08 | 0.00 | 0.00 | 0.00 | 1.44 | 2.68 | 0.17 | 0.25 | 0.00 | 0.19 | 6.27 |
| 1887 | 0.00 | 0.34 | 0.00 | T | 0.08 | 0.00 | 1.49 | 2.39 | 2.92 | 0.45 | 0.37 | 0.15 | 8.19 |
| 1888 | 0.04 | 0.00 | 0.30 | 0.00 | 0.37 | 0.00 | 2.44 | 1.66 | 0.05 | 0.84 | 1.11 | 1.03 | 7.84 |
| 1889 | 0.93 | 0.07 | 0.63 | 0.00 | 0.00 | 0.63 | 2.16 | 0.94 | 1.04 | 0.05 | 0.00 | 1.33 | 7.78 |
| 1890 | 1.94 | 0.00 | 0.00 | 0.23 | 0.00 | 0.52 | [2.50] | 4.81 | 1.44 | *0.41 | 0.50 | 1.48 | [13.83] |
| Means | 0.50 | 0.45 | 0.51 | 0.02 | 0.09 | 0.29 | 1.77 | 2.23 | 0.71 | 0.50 | 0.24 | 0.75 | 8.06 |

### BISBEE, ARIZ.

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1889 | ...... | ...... | ...... | ...... | ...... | ...... | ...... | 0.73 | 3.79 | 0.38 | 0.20 | 0.27 | ...... |
| 1890 | 2.34 | 0.27 | 0.24 | 0.15 | 0.00 | 0.03 | 6.07 | 5.71 | 1.73 | *1.06 | 0.63 | 1.99 | 20.15 |
| Means | ...... | ...... | ...... | ...... | ...... | ...... | ...... | 3.22 | 2.76 | ...... | ...... | ...... | 15.36 |

### BOWIE, FORT, ARIZ.

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1867 | ...... | ...... | ...... | ...... | ...... | ...... | ...... | 2.67 | 1.70 | T | 0.50 | 1.64 | ...... |
| 1868 | 2.39 | 1.10 | 0.00 | 0.70 | 0.50 | 0.00 | 7.15 | 2.40 | 3.15 | T | 0.70 | 0.00 | 18.09 |
| 1869 | 0.10 | 3.50 | 0.39 | 0.15 | 0.00 | 0.40 | 1.30 | 5.60 | 0.20 | T | 1.45 | 0.15 | 13.24 |
| 1870 | 0.30 | 0.69 | 0.50 | T | 0.00 | 0.60 | 4.50 | 5.42 | 1.00 | 0.00 | T | 1.00 | 14.01 |
| 1871 | 0.50 | [1.00] | [0.50] | [0.60] | 0.18 | 0.60 | 7.90 | 2.30 | -1.00 | 0.70 | 0.90 | Blk. | ...... |
| 1872 | [0.40] | [0.50] | 0.00 | 0.25 | 0.20 | 1.04 | 1.67 | 3.36 | 0.77 | T | 0.15 | 2.95 | [11.29] |
| 1873 | 0.00 | 1.16 | 2.22 | T | 1.09 | 0.14 | 0.50 | 1.34 | 0.01 | 0.03 | 1.12 | 2.02 | 9.63 |
| 1874 | 2.33 | 5.40 | 1.50 | 0.35 | 0.00 | T | 2.66 | 3.12 | 0.06 | 1.40 | 1.45 | 0.46 | 18.73 |
| 1875 | 1.35 | 1.20 | 0.13 | 0.13 | T | 0.65 | 4.22 | 1.77 | 3.19 | 0.00 | 0.25 | 0.83 | 13.72 |
| 1876 | 0.60 | 0.45 | 0.48 | T | T | 2.05 | 4.55 | 4.00 | 1.95 | 0.73 | 0.40 | 0.00 | 15.21 |

*Monthly and annual precipitation at seventy-four stations in Arizona*—Continued.

### BOWIE, FORT, ARIZ.—Continued.

| Year. | Jan. | Feb. | Mar. | Apr. | May. | June. | July. | Aug. | Sept. | Oct. | Nov. | Dec. | Annual. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1877 | 0.14 | 2.70 | 0.12 | 0.14 | 0.90 | 0.00 | 1.24 | 0.18 | 1.16 | 0.00 | 0.00 | 2.04 | 8.62 |
| 1878 | [0.50] | 0.50 | 2.83 | 1.00 | 0.20 | 0.20 | 4.92 | 7.44 | 0.07 | 0.07 | 1.50 | 1.09 | [20.32] |
| 1879 | 3.00 | 0.63 | 0.40 | 0.02 | 0.00 | 0.00 | 1.01 | 0.20 | 2.00 | 0.60 | 0.10 | 0.50 | 8.46 |
| 1880 | 0.25 | 1.40 | 1.45 | 0.15 | 0.00 | 1.50 | 4.80 | 0.97 | 1.35 | 0.70 | 0.05 | 0.82 | 13.44 |
| 1881 | 0.00 | 0.20 | 0.79 | 0.05 | 0.10 | 0.06 | 5.53 | 5.16 | 2.27 | 1.15 | 0.58 | 0.03 | 15.92 |
| 1882 | 0.90 | 1.15 | 1.51 | 0.26 | 0.71 | 1.39 | 3.58 | 4.84 | 1.51 | [0.00] | 1.79 | 0.35 | [17.99] |
| 1883 | 1.49 | 1.33 | 2.84 | 0.00 | 1.50 | 0.33 | 2.21 | 1.73 | 0.72 | 0.20 | 0.39 | 1.12 | 13.86 |
| 1884 | 3.14 | 4.96 | 2.63 | 0.00 | 0.23 | 0.12 | 0.65 | 2.44 | 0.62 | 3.58 | 0.42 | 6.41 | 25.20 |
| 1885 | 0.53 | 1.81 | 2.19 | 0.00 | 0.19 | 0.66 | 1.83 | 2.19 | 0.44 | 0.00 | 1.42 | 1.74 | 13.00 |
| 1886 | 4.24 | 4.88 | 4.48 | 0.07 | 0.01 | 4.21 | 2.24 | 2.49 | 1.26 | 0.36 | 0.74 | 0.15 | 25.13 |
| 1887 | 0.13 | 2.11 | 0.00 | 0.23 | T | 1.30 | 4.49 | 5.51 | 2.71 | 1.01 | 1.10 | 1.94 | 20.53 |
| 1888 | 1.11 | 1.50 | 1.92 | T | 0.46 | 0.53 | 2.50 | 1.37 | 0.21 | 1.89 | 1.95 | 2.12 | 15.56 |
| 1889 | 1.38 | 1.62 | 1.58 | T | 0.09 | 0.09 | 2.65 | 0.20 | 3.37 | 0.74 | T | 0.51 | 12.23 |
| 1890 | 0.78 | 0.23 | 0.03 | 0.59 | 0.00 | T | 4.97 | 4.06 | 1.74 | *1.60 | 0.61 | 2.45 | 17.13 |
| Means | 1.11 | 1.77 | 1.27 | 0.19 | 0.28 | 0.69 | 3.28 | 2.90 | 1.34 | 0.57 | 0.74 | 1.27 | 15.41 |

### BUCHANAN, FORT, ARIZ.

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1857 | ...... | ...... | ...... | ...... | ...... | ...... | ...... | 10.60 | 4.76 | 1.07 | 0.00 | 0.69 | ...... |
| 1858 | 1.97 | 0.51 | 0·29 | 1.46 | 0.00 | 0.48 | 3.21 | 3.50 | 1.32 | 0.60 | 0.16 | 2.58 | 16.08 |
| 1859 | 0.54 | 2.36 | 0.00 | 0.50 | 0.00 | 0.20 | 9.24 | 6.67 | 0.74 | 2.33 | 2.84 | 0.40 | 25.82 |
| 1860 | 2.35 | 2.92 | 0·49 | 0.44 | 0.00 | 0.65 | 3.30 | 3.89 | 1.29 | 0.64 | 1.36 | 0.93 | 18.26 |
| 1861 | 1.01 | 0.25 | T | 0.00 | 0.55 | 1.96 | ...... | ...... | ...... | ...... | ...... | ...... | ...... |
| Means | 1.47 | 1.51 | 0.20 | 0.60 | 0.14 | 0.82 | 5.25 | 6.16 | 2.03 | 1.16 | 1.09 | 1.15 | 21.58 |

### BUCKEYE, ARIZ.

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1889 | ...... | ...... | ...... | ...... | ...... | ...... | ...... | 0.51 | 0.20 | 0.96 | 0.36 | 3.93 | ...... |
| 1890 | ...... | ...... | 1.70 | ...... | ...... | ...... | ...... | ...... | ...... | ...... | ...... | ...... | |
| Means | ...... | ...... | ...... | ...... | ...... | ...... | ...... | ...... | ...... | ...... | ...... | ...... | ...... |

### BURKES, ARIZ.

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1877 | ...... | ...... | ...... | ...... | ...... | ...... | ...... | ...... | ...... | ...... | ...... | 0.22 | ...... |
| 1878 | 0.00 | 0.00 | 0.28 | 0.17 | 0.21 | 0.00 | 0.03 | 3.03 | 0.00 | 0.00 | 0.00 | 0.31 | 4.03 |
| 1879 | 0.00 | 1.03 | 0.26 | 0.00 | 0.00 | 0.00 | T | 0.82 | 1.03 | 0.05 | 1.22 | 0.11 | 4.52 |
| 1880 | 0.29 | 1.00 | 0.00 | 0.15 | 0.00 | T | 0.04 | 0.48 | 0.68 | T | 0.00 | [0.50] | [3.14] |
| Means | 0.10 | 0.68 | 0.18 | 0.11 | 0.07 | T | 0.02 | 1.44 | 0.57 | 0.02 | 0.41 | 0.28 | 3.88 |

### BEAL'S SPRINGS, CAMP, ARIZ.

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1873 | ...... | ...... | ...... | 0.00 | 0.27 | T | 0.44 | 3.95 | 1.03 | T | 0.25 | 1.29 | ...... |
| 1874 | 0.50 | 2.50 | 0.25 | ...... | ...... | ...... | ...... | ...... | ...... | ...... | ...... | ...... | ...... |
| Means | ...... | ...... | ...... | ...... | ...... | ...... | ...... | ...... | ...... | ...... | ...... | ...... | 10.48 |

### ARIZONA CANAL COMPANY'S DAM, ARIZ.

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1889 | ...... | ...... | ...... | ...... | ...... | ...... | ...... | 1.70 | 1.00 | 0.12 | 0.08 | 3.80 | ...... |
| 1890 | 0.10 | 0.11 | 0.71 | 0.40 | 0.00 | 0.00 | [1.00] | 1.80 | 0.21 | *0.87 | 1.85 | 1.71 | ...... |
| Means | ...... | ...... | ...... | ...... | ...... | ...... | ...... | 1.75 | 0.60 | ...... | ...... | ...... | 8.67 |

*Monthly and annual precipitation at seventy-four stations in Arizona*—Continued.

### CASA GRANDE, ARIZ.

| Year. | Jan. | Feb. | Mar. | Apr. | May. | June. | July. | Aug. | Sept. | Oct. | Nov. | Dec. | Annual. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1880 | ...... | ...... | ...... | ...... | ...... | ...... | ...... | ...... | ...... | 0.05 | 0.00 | [1.00] | ...... |
| 1881 | 0.00 | 0.00 | [1.00] | 0.73 | 0.00 | 0.00 | 0.00 | T | 0.00 | 0.00 | 0.00 | 0.00 | [1.73] |
| 1882 | [2.00] | [0.80] | 0.00 | 0.00 | 0.00 | [0.10] | 0.00 | 0.00 | 0.00 | 0.00 | ...... | 0.00 | ...... |
| 1883 | 0.00 | 0.00 | 0.00 | 0.00 | 0.24 | 0.00 | [1.00] | 0.81 | 0.00 | 0.10 | 0.00 | 0.86 | [3.01] |
| 1884 | 0.75 | [1.00] | 1.08 | 0.00 | 0.00 | 0.00 | 0.00 | 2.37 | 0.00 | 1.31 | 0.00 | 3.20 | [9.71] |
| 1885 | 0.00 | 0.30 | 0.10 | 0.00 | 0.00 | 0.00 | 0.75 | 0.64 | 0.00 | 0.00 | 0.23 | 0.00 | 2.02 |
| 1886 | 0.90 | [1.25] | 0.74 | 0.09 | 0.00 | 0.00 | 0.33 | 1.46 | 0.00 | 0.00 | 0.35 | 0.00 | [5.12] |
| 1887 | 0.00 | 0.40 | 0.00 | 0.30 | 0.20 | 0.40 | 1.07 | 0.97 | 1.99 | 0.95 | 1.28 | 0.15 | 7.71 |
| 1888 | 0.61 | 0.00 | 0.45 | 0.00 | [0.10] | 0.00 | 0.28 | 0.00 | 0.41 | †[1.00] | 0.70 | 0.75 | [4.30] |
| 1889 | [1.00] | 0.00 | 0.50 | 0.10 | 0.00 | 0.00 | 0.00 | 0.00 | 0.50 | 0.80 | 0.10 | 1.25 | [4.25] |
| 1890 | 0.30 | 0.61 | 0.41 | 0.38 | 0.00 | 0.00 | 1.38 | 3.41 | 0.96 | *0.38 | 2.00 | 0.87 | 10.70 |
| Means | 0.40 | 0.40 | 0.43 | 0.16 | 0.05 | 0.04 | 0.38 | 0.69 | 0.32 | 0.42 | 0.30 | 0.69 | 4.28 |

### CALABASAS, ARIZ.

| Year. | Jan. | Feb. | Mar. | Apr. | May. | June. | July. | Aug. | Sept. | Oct. | Nov. | Dec. | Annual. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1889 | ...... | ...... | ...... | ...... | ...... | 0.13 | 3.40 | 2.48 | 2.51 | [0.40] | 0.00 | 0.83 | ...... |
| 1890 | 2.62 | 0.38 | 0.00 | 0.21 | 0.13 | 0.00 | ...... | ...... | ...... | *0.10 | 0.50 | 1.95 | ...... |
| Means | 2.62 | 0.38 | 0.00 | 0.21 | 0.13 | 0.06 | 3.40 | 2.48 | 2.51 | 0.94 | 0.00 | 0.83 | 13.02 |

### CHIRICAHUA MOUNTAINS, ARIZ.

| Year. | Jan. | Feb. | Mar. | Apr. | May. | June. | July. | Aug. | Sept. | Oct. | Nov. | Dec. | Annual. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1889 | ...... | ...... | ...... | ...... | ...... | ...... | ...... | ...... | 0.94 | 1.42 | 0.00 | 1.55 | ...... |
| 1890 | 3.80 | 0.00 | 0.00 | 0.89 | 5.00 | 0.00 | 1.18 | 3.83 | *2.19 | 2.85 | 1.72 | 2.90 | 19.36 |
| Means | ...... | ...... | ...... | ...... | ...... | ...... | ...... | ...... | ...... | ...... | ...... | ...... | 13.61 |

### CEDAR SPRINGS, ARIZ.

| Year. | Jan. | Feb. | Mar. | Apr. | May. | June. | July. | Aug. | Sept. | Oct. | Nov. | Dec. | Annual. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1888 | ...... | ...... | ...... | ...... | 0.30 | T | 0.69 | 0.17 | 0.62 | [2.00] | 2.55 | 2.50 | ...... |
| 1889 | 2.16 | 1.27 | 1.40 | 0.22 | 0.00 | 0.47 | 2.60 | 3.60 | [2.00] | [1.00] | 0.22 | [1.50] | 16.44 |
| Means | ...... | ...... | ...... | ...... | 0.15 | 0.24 | 1.64 | 1.88 | 1.31 | 1.50 | 1.38 | 2.00 | 15.15 |

### COLORADO, CAMP, ARIZ.

| Year. | Jan. | Feb. | Mar. | Apr. | May. | June. | July. | Aug. | Sept. | Oct. | Nov. | Dec. | Annual. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1869 | T | 0.21 | 0.50 | 0.15 | 0.00 | T | 0.00 | 0.30 | 0.00 | 0.10 | 1.00 | 0.20 | 2.46 |
| 1870 | 0.30 | T | 0.00 | 0.00 | 0.05 | 0.00 | 0.06 | 0.20 | 0.00 | 0.50 | 0.00 | [0.70] | [1.81] |
| 1871 | T | T | ...... | ...... | ...... | ...... | ...... | ...... | ...... | ...... | ...... | ...... | ...... |
| Means | 0.10 | 0.07 | 0.25 | 0.08 | 0.02 | T | 0.03 | 0.25 | 0.00 | 0.30 | 0.50 | 0.45 | 2.05 |

### CHLORIDE, ARIZ.

| Year. | Jan. | Feb. | Mar. | Apr. | May. | June. | July. | Aug. | Sept. | Oct. | Nov. | Dec. | Annual. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1889 | ...... | ...... | ...... | ...... | ...... | ...... | 0.14 | 1.00 | 0.60 | 0.85 | 0.19 | 7.53 | ...... |
| 1890 | 1.60 | 1.65 | 0.68 | 0.70 | 0.00 | [0.00] | ...... | ...... | ...... | ...... | ...... | *2.27 | ...... |
| Means | ...... | ...... | ...... | ...... | ...... | ...... | ...... | ...... | ...... | ...... | ...... | ...... | 14.94 |

### COOLEY'S SPRINGS, ARIZ.

| Year. | Jan. | Feb. | Mar. | Apr. | May. | June. | July. | Aug. | Sept. | Oct. | Nov. | Dec. | Annual. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1889 | ...... | ...... | ...... | ...... | ...... | ...... | 2.74 | 2.95 | 1.46 | 0.12 | 2.85 | 4.20 | ...... |
| 1890 | 3.20 | 2.79 | 1.25 | 2.38 | 0.04 | 0.00 | 4.63 | 4.60 | 1.61 | *5.78 | ...... | ...... | ...... |
| Means | ...... | ...... | ...... | ...... | ...... | ...... | 3.68 | 3.78 | 1.54 | ...... | ...... | ...... | 25.83 |

*Monthly and annual precipitation at seventy-four stations in Arizona*—Continued.

### COTTONWOOD, ARIZ.

| Year. | Jan. | Feb. | Mar. | Apr. | May. | June. | July. | Aug. | Sept. | Oct. | Nov. | Dec. | Annual. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1889 | ...... | ...... | ...... | ...... | ...... | ...... | 3.70 | 1.10 | 1.10 | 0.22 | 0.12 | 5.00 | ...... |
| 1890 | 1.90 | 3.90 | ...... | ...... | ...... | ...... | ...... | ...... | 3.80 | *0.36 | 3.80 | 2.60 | ...... |
| Means | 1.90 | 3.90 | ...... | ...... | ...... | ...... | 2.85 | 1.80 | 2.45 | 0.22 | 0.12 | 5.00 | ...... |

### CRITTENDEN, CAMP, ARIZ.

| Year. | Jan. | Feb. | Mar. | Apr. | May. | June. | July. | Aug. | Sept. | Oct. | Nov. | Dec. | Annual. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1868 | ...... | ...... | ...... | 0.39 | 0.05 | T | 11.72 | 4.07 | 0.40 | 0.30 | ...... | 0.50 | ...... |
| 1869 | 1.10 | 2.50 | 0.95 | T | 0.00 | 0.16 | 4.74 | 5.35 | 1.55 | 0.46 | 1.01 | 1.26 | 19.08 |
| 1870 | 0.87 | 0.70 | 1.13 | 0.27 | 0.00 | 0.39 | 4.71 | 5.55 | 0.64 | 0.00 | 0.00 | 1.91 | 16.17 |
| 1871 | 0.33 | 0.98 | 0.52 | 0.35 | 0.20 | 0.34 | 5.70 | 4.55 | 1.18 | 0.05 | 0.11 | 0.40 | 14.71 |
| 1872 | 0.31 | 0.19 | 0.00 | 0.30 | T | 0.68 | 3.17 | [4.00] | [0.50] | 0.13 | 0.00 | 3.76 | [13.04] |
| 1873 | 0.12 | ...... | ...... | ...... | ...... | ...... | ...... | ...... | ...... | ...... | ...... | ...... | ...... |
| Means | 0.55 | 1.09 | 0.65 | 0.26 | 0.05 | 0.31 | 6.01 | 4.70 | 0.85 | 0.19 | 0.28 | 1.57 | 16.51 |

### CRITTENDEN, ARIZ.

| Year. | Jan. | Feb. | Mar. | Apr. | May. | June. | July. | Aug. | Sept. | Oct. | Nov. | Dec. | Annual. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1889 | ...... | ...... | ...... | ...... | ...... | ...... | 2.17 | 2.32 | 1.70 | 0.30 | 0.00 | ...... | ...... |
| 1890 | ...... | ...... | ...... | ...... | ...... | ...... | 6.00 | 5.95 | 2.60 | *1.42 | ...... | ...... | ...... |
| Means | ...... | ...... | ...... | ...... | ...... | ...... | 4.08 | 4.14 | 2.15 | ...... | ...... | ...... | ...... |

### DATE CREEK, CAMP, ARIZ.

| Year. | Jan. | Feb. | Mar. | Apr. | May. | June. | July. | Aug. | Sept. | Oct. | Nov. | Dec. | Annual. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1867 | ...... | ...... | ...... | ...... | 0.13 | 0.00 | 2.81 | 1.23 | 0.18 | 0.03 | 0.98 | 4.09 | ...... |
| 1868 | 3.12 | 2.27 | 1.55 | 1.40 | 0.63 | 0.00 | 7.24 | 8.30 | 0.93 | 0.70 | 0.75 | 0.95 | 27.84 |
| 1869 | 2.01 | 2.85 | 2.86 | 1.39 | 0.00 | 1.49 | 2.18 | 4.67 | T | T | 1.90 | 1.15 | 20.50 |
| 1870 | 0.29 | 0.70 | 1.06 | [0.10] | T | T | 5.70 | 3.12 | 0.00 | 1.50 | 0.23 | 1.00 | 13.70 |
| 1871 | 0.10 | 1.00 | T | 1.20 | 0.04 | 0.00 | 2.17 | 0.84 | 0.62 | 0.44 | T | 0.06 | 6.47 |
| 1872 | T | 0.80 | T | 2.05 | 0.00 | 0.07 | 1.86 | 4.55 | 0.00 | 0.07 | 0.00 | 1.15 | 10.55 |
| 1873 | 0.00 | 1.86 | 0.24 | 0.04 | 0.08 | 0.11 | 0.36 | 1.04 | ...... | ...... | ...... | ...... | ...... |
| Means | 0.92 | 1.58 | 0.95 | 1.03 | 0.13 | 0.24 | 3.19 | 3.39 | 0.29 | 0.46 | 0.64 | 1.40 | 14.22 |

### DEFIANCE, FORT, ARIZ.

| Year. | Jan. | Feb. | Mar. | Apr. | May. | June. | July. | Aug. | Sept. | Oct. | Nov. | Dec. | Annual. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1852 | ...... | ...... | ...... | ...... | 0.89 | 2.35 | 0.90 | 1.30 | 1.82 | 1.60 | 1.22 | 1.30 | ...... |
| 1853 | 0.40 | 0.08 | 1.29 | 0.10 | 1.44 | 0.43 | 1.43 | 4.65 | 2.64 | 0.94 | 0.22 | 0.25 | 13.87 |
| 1854 | 2.20 | 0.15 | 0.45 | 0.93 | 1.51 | 1.24 | 3.94 | 5.24 | 3.47 | 0.62 | 1.49 | 1.20 | 22.44 |
| 1855 | 0.83 | 1.71 | 3.30 | 0.51 | 0.10 | 0.43 | 1.54 | [2.74] | 2.86 | 0.00 | 1.47 | 1.59 | 17.08 |
| 1856 | 0.82 | 1.54 | 0.54 | 0.78 | 0.33 | 0.10 | 2.14 | 3.07 | 1.75 | 0.00 | 0.18 | 0.40 | 11.65 |
| 1857 | 0.20 | 0.67 | 0.00 | 0.51 | 0.04 | 0.45 | 1.30 | 1.78 | 1.01 | 1.73 | 4.30 | 1.07 | 13.06 |
| 1858 | 0.54 | 0.54 | 0.59 | 1.64 | 0.00 | 0.27 | 2.22 | 3.32 | 0.95 | 0.28 | 0.28 | 1.34 | 11.97 |
| 1859 | 0.02 | 0.77 | 0.41 | 0.85 | 0.39 | 0.63 | 2.72 | 2.17 | 1.79 | 0.30 | ...... | 0.23 | ...... |
| 1860 | 2.86 | 0.12 | 0.13 | 0.02 | 0.00 | [0.60] | 5.77 | 0.30 | 0.49 | 0.80 | 0.15 | 0.46 | 11.70 |
| Means | 0.98 | 0.70 | 0.84 | 0.67 | 0.52 | 0.72 | 2.44 | 2.73 | 1.86 | 0.70 | 1.16 | 0.87 | 14.19 |

### DOS CABEZAS, ARIZ.

| Year. | Jan. | Feb. | Mar. | Apr. | May. | June. | July. | Aug. | Sept. | Oct. | Nov. | Dec. | Annual. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1889 | ...... | ...... | ...... | ...... | ...... | ...... | ...... | ...... | 0.58 | 1.11 | T | 0.12 | ...... |
| 1890 | 1.28 | 0.29 | 0.08 | 0.95 | 0.00 | 0.03 | 3.90 | 5.07 | 1.36 | *1.12 | 0.42 | 2.31 | 16.81 |
| Means | ...... | ...... | ...... | ...... | ...... | ...... | ...... | ...... | 0.97 | ...... | ...... | ...... | 13.80 |

### DRAGOON, ARIZ.

| Year. | Jan. | Feb. | Mar. | Apr. | May. | June. | July. | Aug. | Sept. | Oct. | Nov. | Dec. | Annual. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1889 | ...... | ...... | ...... | ...... | ...... | ...... | ...... | ...... | 0.18 | [0.75] | 0.00 | 0.97 | ...... |
| 1890 | 2.11 | 0.43 | 0.00 | 0.32 | 0.00 | 0.00 | 4.09 | 4.73 | 2.48 | *1.01 | 0.20 | 2.01 | 17.38 |
| Means | ...... | ...... | ...... | ...... | ...... | ...... | ...... | ...... | 1.33 | ...... | ...... | ...... | 14.73 |

*Monthly and annual precipitation at seventy-four stations in Arizona*—Continued.

### DUDLEYVILLE, ARIZ.

| Year. | Jan. | Feb. | Mar. | Apr. | May. | June. | July. | Aug. | Sept. | Oct. | Nov. | Dec. | Annual. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1889 | ...... | ...... | ...... | ...... | ...... | ...... | 2.46 | 2.50 | 1.55 | 0.78 | 0.82 | 1.88 | ...... |
| 1890 | 1.63 | 1.46 | 0.52 | 0.75 | 0.00 | 0.00 | [2.00] | 4.07 | 0.90 | *0.84 | ...... | 1.67 | ...... |
| Means | ...... | ...... | ...... | ...... | ...... | ...... | 2.23 | 3.28 | 1.22 | ...... | ...... | ...... | 14.57 |

### EAGLE PASS (CURTIS), ARIZ.

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1888 | ...... | ...... | ...... | ...... | 0.20 | ...... | ...... | ...... | ...... | ...... | 2.84 | 3.13 | ...... |
| 1889 | 1.84 | 1.80 | 1.01 | 0.05 | T | 0.04 | 2.53 | 5.42 | 2.10 | 1.15 | 0.38 | 1.69 | 18.01 |
| 1890 | 3.03 | 0.51 | 0.80 | 0.79 | 0.00 | T | 3.15 | 4.70 | 1.76 | *1.75 | 1.34 | 2.10 | 19.93 |
| Means | 2.44 | 1.16 | 0.90 | 0.42 | 0.07 | 0.02 | 2.84 | 5.06 | 1.93 | 1.15 | 1.61 | 2.41 | 20.01 |

### FLAGSTAFF, ARIZ.

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1888 | ...... | ...... | ...... | ...... | ...... | ...... | 4.75 | 1.00 | 1.00 | 1.05 | 2.35 | [7.00] | ...... |
| 1889 | ...... | ...... | ...... | 0.75 | 0.65 | 0.30 | 5.00 | 0.65 | 1.19 | 1.69 | 0.50 | 7.87 | ...... |
| 1890 | 0.72 | 4.20 | 2.30 | ...... | ...... | ...... | ...... | ...... | ...... | ...... | ...... | ...... | ...... |
| Means | ...... | ...... | ...... | ...... | ...... | ...... | 4.88 | 0.82 | 1.10 | 1.37 | 1.42 | 7.44 | 25.95 |

### FLORENCE, ARIZ.

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1875 | ...... | ...... | ...... | ...... | ...... | ...... | ...... | ...... | ...... | ...... | 0.02 | 0.64 | ...... |
| 1876 | 1.08 | 0.00 | 0.10 | T | 0.00 | 0.07 | 4.53 | 1.24 | 0.26 | 1.26 | 0.79 | 0.00 | 9.33 |
| 1877 | 0.34 | 0.92 | 0.33 | 0.00 | 0.31 | 0.00 | 0.00 | 0.13 | 0.81 | 0.49 | 0.00 | 2.02 | 5.35 |
| 1878 | 0.06 | 1.03 | 1.09 | 1.55 | T | 0.00 | 0.21 | 3.58 | 2.75 | 0.00 | 1.37 | 1.85 | 13.49 |
| 1879 | 1.23 | 1.15 | 0.96 | 0.33 | 0.00 | 0.00 | 1.33 | 2.52 | 1.01 | 1.29 | 0.79 | 1.41 | 12.02 |
| 1880 | 0.76 | 0.49 | 0.21 | 0.20 | 0.00 | 0.05 | 1.22 | 0.54 | 0.55 | 0.13 | 0.00 | 1.20 | 5.35 |
| 1881 | 0.00 | 0.03 | 1.98 | 0.86 | 0.13 | 0.00 | 2.25 | 4.28 | 1.00 | 1.13 | 0.34 | 0.14 | 12.14 |
| 1882 | 2.28 | 1.11 | 0.23 | 0.68 | 0.00 | 0.00 | 1.83 | 1.89 | ...... | ...... | ...... | ...... | ...... |
| 1889 | 1.26 | 0.84 | 2.83 | 0.13 | 0.00 | 0.00 | 0.00 | 0.53 | 0.34 | 0.44 | 0.47 | 2.06 | 8.90 |
| 1890 | 1.34 | [1.00] | 0.23 | 0.68 | 0.00 | 0.00 | 1.83 | 1.89 | 0.90 | *0.41 | 2.36 | 2.96 | ...... |
| Means | 0.93 | 0.70 | 0.80 | 0.49 | 0.05 | 0.02 | 1.36 | 1.83 | 0.96 | 0.68 | 0.47 | 1.16 | 9.45 |

### GILA BEND, ARIZ.

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1889 | ...... | ...... | ...... | ...... | ...... | ...... | 0.36 | 1.03 | 0.00 | 1.50 | 0.00 | 2.80 | ...... |
| 1890 | 0.00 | 0.40 | 0.00 | 0.00 | 0.00 | 0.00 | 1.40 | 3.90 | 0.00 | *0.05 | 0.64 | 1.42 | ...... |
| Means | ...... | ...... | ...... | ...... | ...... | ...... | 0.88 | 2.46 | 0.00 | ...... | ...... | ...... | 8.04 |

### GILLETTE, ARIZ.

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1889 | ...... | ...... | ...... | ...... | ...... | ...... | *1.62 | 1.05 | 0.00 | 1.90 | 0.00 | 6.15 | ...... |
| 1890 | 1.68 | ...... | ...... | ...... | ...... | ...... | ...... | ...... | ...... | ...... | ...... | ...... | ...... |

### GLOBE, ARIZ.

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1888 | ...... | ...... | ...... | ...... | ...... | ...... | 2.47 | 1.38 | 0.65 | 2.39 | 3.61 | 2.18 | ...... |
| 1889 | 2.15 | 1.11 | 2.33 | 0.43 | 0.00 | 0.38 | 1.36 | 1.19 | 5.90 | 1.94 | ...... | ...... | ...... |
| Means | ...... | ...... | ...... | ...... | ...... | ...... | 1.92 | 1.28 | 3.28 | 2.16 | ...... | ...... | ...... |

***Monthly and annual precipitation at seventy-four stations in Arizona*—Continued.**

GOODWIN, CAMP, ARIZ.

| Year. | Jan. | Feb. | Mar. | Apr. | May. | June. | July. | Aug. | Sept. | Oct. | Nov. | Dec. | Annual. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1866 | 2.06 | 2.62 | [1.03] | 2.67 | ...... | ...... | ...... | ...... | 10.40 | 3.70 | ...... | 4.74 | ...... |
| 1867 | 7.55 | 1.55 | 1.87 | 0.00 | 0.00 | 0.00 | 3.47 | 3.73 | 1.30 | 0.85 | 2.40 | 5.20 | 27.92 |
| 1868 | 1.40 | 0.58 | 0.73 | 2.40 | T | 0.00 | 3.39 | 2.16 | 3.49 | 0.50 | 0.75 | 0.60 | 16.00 |
| 1869 | 0.85 | 2.30 | 1.55 | 0.38 | 0.00 | 2.06 | 3.20 | 11.45 | 0.02 | 0.51 | 0.40 | 0.71 | 23.33 |
| 1870 | 0.20 | 2.17 | 0.02 | 1.05 | 0.00 | ...... | ...... | ...... | ...... | ...... | ...... | ...... | ...... |
| Means | 2.41 | 1.82 | 1.04 | 1.30 | T | 0.69 | 3.35 | 5.78 | 3.80 | 1.39 | 1.18 | 2.81 | 25.57 |

OLD CAMP GRANT (BRECKENRIDGE), ARIZ.

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1866 | ...... | ...... | ...... | ...... | ...... | ...... | ...... | ...... | 3.10 | 0.00 | 3.33 | 0.33 | ...... |
| 1867 | 1.90 | 1.00 | 0.50 | T | T | T | ...... | ...... | ...... | 0.00 | ...... | ...... | ...... |
| 1868 | ...... | ...... | ...... | 2.10 | 0.00 | 0.00 | 3.35 | 1.30 | 4.65 | 0.00 | ...... | ...... | ...... |
| 1869 | 1.36 | 0.76 | 0.68 | ...... | T | 0.14 | 1.73 | 1.62 | 0.00 | 0.05 | 0.54 | 0.56 | ...... |
| 1870 | 0.19 | 0.54 | 0.66 | 0.12 | 0.00 | 0.05 | 2.32 | 2.98 | 0.09 | 0.00 | 0.10 | 1.90 | 8.95 |
| 1871 | 0.06 | 1.20 | 0.40 | 3.11 | 0.20 | 1.90 | 11.70 | 10.28 | 2.76 | 0.10 | 2.00 | 1.50 | 35.21 |
| 1872 | 1.50 | 0.30 | 0.00 | 0.70 | 0.40 | 0.90 | 4.10 | 4.20 | 1.10 | 0.30 | T | 1.18 | 14.68 |
| Means | 1.00 | 0.76 | 0.45 | 1.21 | 0.10 | 0.50 | 4.64 | 4.08 | 1.95 | 0.06 | 1.19 | 1.09 | 17.03 |

GRANT, FORT, ARIZ.

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1873 | 0.00 | 0.10 | 1.00 | 0.00 | 0.50 | 1.40 | 1.70 | 5.20 | 2.50 | 0.46 | 3.38 | 1.75 | 17.99 |
| 1874 | 1.58 | 2.87 | 2.45 | 0.58 | 0.07 | 0.00 | 2.70 | 2.01 | 0.00 | 1.47 | 0.30 | 3.78 | 17.81 |
| 1875 | 2.48 | 1.44 | 1.95 | 1.52 | 0.00 | 0.50 | 7.02 | 1.08 | 4.59 | 0.01 | 0.20 | 0.12 | 20.91 |
| 1876 | 0.26 | 0.24 | 0.44 | ...... | ...... | 0.65 | 5.27 | 7.41 | 1.99 | 2.86 | 1.00 | ...... | ...... |
| 1877 | 0.17 | 1.50 | 0.30 | 0.42 | 0.66 | 0.00 | 0.94 | 0.60 | 2.88 | 0.59 | 0.00 | 2.16 | 10.13 |
| 1878 | 0.23 | 0.50 | 0.37 | 0.18 | 0.00 | 0.32 | 6.44 | 4.93 | 0.20 | 0.00 | 1.90 | 1.39 | 16.46 |
| 1879 | 1.38 | 0.47 | 0.85 | 0.07 | 0.00 | 0.08 | 2.59 | 1.12 | 2.18 | 1.83 | 0.87 | 1.38 | 12.82 |
| 1880 | 0.60 | 0.46 | 0.85 | 0.08 | 0.00 | 1.32 | 5.63 | 3.73 | 1.01 | 0.47 | 0.00 | 1.57 | 15.74 |
| 1881 | 0.05 | 0.33 | 0.89 | 0.84 | 0.26 | T | 5.53 | 5.47 | 3.84 | 1.02 | 0.08 | 0.65 | 18.96 |
| 1882 | 0.86 | 1.26 | 1.84 | 0.07 | 0.81 | 1.47 | 2.62 | 4.73 | 0.80 | 0.00 | 0.79 | 0.17 | 15.42 |
| 1883 | 1.21 | 1.40 | 1.27 | 0.03 | 1.16 | 1.26 | 2.90 | 3.07 | 0.42 | 1.21 | 0.11 | 1.44 | 15.48 |
| 1884 | 1.12 | 4.62 | 3.87 | 0.47 | 0.81 | 1.20 | 0.67 | 2.41 | 0.98 | 3.06 | 0.53 | 5.93 | 25.67 |
| 1885 | 0.31 | 1.02 | 1.40 | 0.04 | 0.25 | 0.73 | 0.93 | 1.58 | 0.81 | 0.03 | 1.30 | 0.81 | 9.21 |
| 1886 | 2.46 | 1.29 | 0.53 | 0.30 | 0.04 | No record. | | 3.40 | 3.49 | 0.57 | 0.10 | 0.09 | ...... |
| 1887 | 0.11 | 2.58 | T | 0.36 | 0.16 | 0.85 | 9.00 | 6.20 | 4.20 | 0.37 | 0.28 | 0.21 | 24.32 |
| 1888 | 0.12 | 0.44 | 0.83 | 0.50 | 0.18 | 0.02 | 4.27 | 0.52 | 0.78 | 1.19 | 3.67 | 1.68 | 14.20 |
| 1889 | 1.99 | 1.28 | 1.04 | 0.13 | T | 1.06 | 3.57 | 1.35 | 0.69 | 0.94 | 0.16 | 1.11 | 13.32 |
| 1890 | 1.58 | 0.46 | 0.46 | 0.92 | 0.01 | 0.20 | 3.23 | 4.54 | 0.69 | *1.62 | 0.16 | 2.01 | 15.88 |
| Means | 0.92 | 1.24 | 1.13 | 0.38 | 0.29 | 0.65 | 3.86 | 3.22 | 1.84 | 0.94 | 0.86 | 1.52 | 16.85 |

GRAND CENTRAL MILL (NEAR FAIRBANK), ARIZ.

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1889 | ...... | ...... | ...... | ...... | ...... | ...... | 5.19 | 2.57 | 1.07 | 0.14 | 0.00 | 0.35 | ...... |
| 1890 | 1.65 | 0.00 | 0.00 | 0.15 | 0.00 | 0.15 | 2.74 | 6.48 | 3.12 | *0.90 | 0.28 | 1.01 | 16.48 |
| Means | ...... | ...... | ...... | ...... | ...... | ...... | 3.96 | 4.52 | 2.10 | ...... | ...... | ...... | 13.02 |

HOLBROOK, ARIZ.

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1886 | ...... | ...... | ...... | ...... | ...... | ...... | ...... | ...... | ...... | ...... | ...... | 0.27 | ...... |
| 1887 | 0.10 | 1.11 | 0.06 | 0.82 | 0.27 | 0.24 | 1.98 | 1.11 | 1.88 | 1.05 | 0.54 | 0.40 | 9.56 |
| 1888 | 1.00 | 1.18 | 1.24 | 0.76 | 0.29 | 0.05 | 0.68 | 0.74 | 0.87 | 0.50 | 2.20 | 1.31 | 10.82 |
| 1889 | 0.30 | 0.29 | 0.82 | 0.10 | 0.09 | 0.20 | 2.06 | 1.20 | 0.67 | 0.49 | 0.50 | 0.91 | 7.63 |
| 1890 | 0.77 | 0.25 | 0.75 | 1.01 | 0.00 | 0.00 | 1.32 | 2.57 | 1.32 | *0.62 | 2.08 | 1.82 | 12.34 |
| Means | 0.54 | 0.71 | 0.72 | 0.67 | 0.16 | 0.12 | 1.51 | 1.40 | 1.18 | 0.68 | 1.08 | 0.72 | 9.29 |

*Monthly and annual precipitation at seventy-four stations in Arizona*—Continued.

### HUACHUCA, FORT, ARIZ.

| Year. | Jan. | Feb. | Mar. | Apr. | May. | June. | July. | Aug. | Sept. | Oct. | Nov. | Dec. | Annual. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1886 | 1.18 | 1.94 | 0.20 | T | 0.00 | 0.00 | 1.41 | 4.24 | 1.46 | 0.84 | T | 0.20 | 11.47 |
| 1887 | 0.00 | 1.30 | 0.00 | 0.00 | 0.00 | 0.72 | 4.08 | 2.00 | 3.48 | 0.74 | 1.16 | 1.80 | [15.28] |
| 1888 | 0.10 | 0.30 | 0.96 | 0.00 | 0.60 | 1.06 | 7.96 | 2.05 | 0.96 | 2.12 | 2.78 | 1.06 | 19.95 |
| 1889 | 1.90 | 1.55 | 2.71 | 0.22 | 0.00 | 0.16 | 3.66 | 1.80 | 2.46 | 0.04 | 0.14 | 0.75 | 15.39 |
| 1890 | 1.50 | 0.10 | T | 0.34 | [0.00] | T | 4.38 | 4.49 | 4.68 | *0.37 | 1.04 | 2.70 | 19.60 |
| Means | 0.80 | 1.27 | 0.97 | 0.11 | 0.15 | 0.39 | 4.29 | 2.92 | 2.61 | 0.94 | 1.02 | 0.95 | 16.42 |

### HUALPAI, CAMP, ARIZ.

| Year. | Jan. | Feb. | Mar. | Apr. | May. | June. | July. | Aug. | Sept. | Oct. | Nov. | Dec. | Annual. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1870 | ...... | ...... | ...... | 0.07 | 1.18 | 0.10 | 4.91 | 4.85 | [0.00] | 1.10 | 0.35 | 0.70 | ........ |
| 1871 | 0.00 | 0.40 | 0.00 | 1.97 | 0.10 | 0.10 | [4.00] | 2.80 | 4.10 | 0.60 | 0.00 | 0.20 | [14.27] |
| 1872 | 0.10 | 0.70 | 0.00 | 1.20 | 0.20 | 3.60 | 2.30 | 6.40 | 2.20 | 0.30 | 0.50 | 1.70 | 19.20) |
| 1873 | 0.10 | 4.65 | 0.00 | [0.10] | 0.40 | 0.13 | ...... | ...... | ...... | ...... | ...... | ...... | ........ |
| Means | 0.07 | 1.92 | 0.00 | 0.84 | 0.47 | 0.98 | 3.74 | 4.68 | 2.10 | 0.67 | 0.28 | 0.87 | 16.62 |

### HUACHUCA MOUNTAIN (NEAR BASE, SOUTH SIDE), ARIZ.

| Year. | Jan. | Feb. | Mar. | Apr. | May. | June. | July. | Aug. | Sept. | Oct. | Nov. | Dec. | Annual. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1888 | ...... | ...... | ...... | ...... | ...... | 0.76 | 4.45 | 2.41 | 0.50 | 0.49 | 3.46 | 1.42 | ........ |
| 1889 | 2.37 | 0.34 | 2.61 | 0.14 | T | 0.55 | 5.44 | 0.54 | 3.04 | 0.63 | T | 0.21 | 15.87 |
| 1890 | 2.51 | 0.16 | 0.03 | 0.32 | 0.00 | 0.00 | 3.33 | 4.46 | 2.25 | *0.69 | 1.37 | ...... | ........ |
| Means | 2.44 | 0.25 | 1.32 | 0.23 | T | 0.44 | 4.41 | 2.47 | 1.93 | 0.56 | 1.73 | 0.82 | 16.60 |

### LOCHIEL, ARIZ.

| Year. | Jan. | Feb. | Mar. | Apr. | May. | June. | July. | Aug. | Sept. | Oct. | Nov. | Dec. | Annual. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1888 | ...... | ...... | ...... | ...... | ...... | 1.00 | 8.03 | 0.40 | 3.10 | 1.00 | 2.00 | 1.60 | ........ |
| 1889 | 1.90 | ...... | 1.91 | [0.10] | [0.00] | 1.55 | 3.77 | 1.67 | 2.17 | 0.55 | 0.00 | 0.65 | ........ |
| 1890 | 3.06 | 0.43 | 0.02 | [0.20] | [1.07] | 0.10 | 4.87 | 7.18 | 4.53 | *0.88 | 1.11 | 3.45 | ........ |
| Means | 2.48 | 0.43 | 0.96 | 0.10 | 0.00 | 0.88 | 5.90 | 1.04 | 2.64 | 0.78 | 1.00 | 1.12 | 17.43 |

### LOWELL, FORT (TUCSON), ARIZ.

| Year. | Jan. | Feb. | Mar. | Apr. | May. | June. | July. | Aug. | Sept. | Oct. | Nov. | Dec. | Annual. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1867 | ...... | ...... | ...... | ...... | 0.00 | 0.00 | 2.90 | 1.40 | 0.60 | T | ...... | 1.70 | ........ |
| 1868 | 0.57 | 0.57 | 0.30 | 1.09 | 1.00 | 0.00 | 3.34 | 0.67 | 3.83 | 0.25 | 0.32 | 0.50 | 12.44 |
| 1869 | 1.09 | 1.58 | 0.70 | T | 0.00 | 0.35 | 2.49 | 6.31 | 0.30 | 0.03 | 1.01 | 0.83 | 14.69 |
| 1870 | 0.02 | 0.20 | 0.03 | 0.16 | 0.00 | T | 2.82 | 2.04 | T | 0.00 | 0.00 | 0.94 | 6.21 |
| 1871 | 0.52 | 0.64 | 0.16 | 0.04 | T | 0.40 | 1.02 | 3.70 | 2.00 | T | 0.21 | 1.00 | 9.69 |
| 1872 | 0.54 | 0.12 | 0.00 | 0.05 | 0.01 | 0.26 | 3.94 | 3.81 | 3.06 | 0.40 | 0.00 | 1.39 | 13.58 |
| 1873 | 0.00 | 0.69 | 1.01 | 0.00 | T | 0.00 | 0.08 | 2.73 | 0.62 | 0.00 | 1.32 | 0.97 | 7.42 |
| 1874 | 1.76 | 1.66 | 1.19 | 0.43 | 0.07 | 0.00 | 4.82 | 1.93 | 0.00 | 1.08 | 0.92 | 0.37 | 14.23 |
| 1875 | 0.37 | 1.22 | 0.00 | 0.09 | 0.00 | 0.20 | 4.22 | 2.09 | 2.39 | 0.00 | 0.05 | 0.53 | 11.16 |
| 1876 | 0.21 | 0.27 | 1.14 | T | T | 2.05 | 4.83 | 2.70 | 1.95 | 2.65 | 0.25 | T | 16.05 |
| 1877 | 0.95 | 1.45 | 0.12 | 0.88 | 0.42 | 0.00 | 0.86 | 0.34 | 1.76 | 0.68 | 0.00 | 2.38 | 9.84 |
| 1878 | 0.12 | 1.12 | 1.06 | 0.48 | 0.00 | 0.16 | 0.60 | 7.88 | 0.14 | 0.00 | 2.30 | 0.52 | 14.38 |
| 1879 | 1.54 | 2.56 | 0.18 | 0.00 | 0.00 | 0.00 | 2.50 | 1.26 | 1.12 | 0.80 | 0.72 | 0.70 | 11.38 |
| 1880 | 0.62 | 0.00 | 0.64 | 0.16 | 0.00 | 0.20 | 1.88 | 3.64 | 0.38 | 0.12 | 0.00 | 1.06 | 8.70 |
| 1881 | 0.20 | 0.12 | 0.94 | 0.67 | 0.00 | 0.00 | 3.62 | ...... | 2.04 | 1.26 | 0.00 | 0.30 | ........ |
| 1882 | 2.30 | 1.90 | 0.94 | 0.30 | 0.32 | 1.54 | 1.18 | 3.60 | 0.38 | 0.00 | 1.48 | 0.12 | 14.06 |
| 1883 | 3.02 | 1.20 | 1.06 | 0.00 | ...... | ...... | ...... | ...... | ...... | 0.78 | 0.48 | 3.18 | ........ |
| 1884 | 4.74 | 5.23 | 2.90 | 0.08 | ...... | ...... | ...... | ...... | ...... | ...... | ...... | ...... | ........ |
| 1886 | ...... | ...... | 1.12 | 0.14 | 0.00 | 0.00 | T | 1.24 | 1.04 | 0.12 | 0.12 | 0.10 | ........ |
| 1887 | 0.00 | ...... | ...... | ...... | ...... | ...... | ...... | ...... | ...... | ...... | ...... | ...... | ........ |
| 1889 | 2.09 | 0.76 | 2.46 | 0.30 | 0.00 | 0.45 | 3.36 | 2.07 | 3.32 | 0.34 | 0.19 | 1.58 | 16.92 |
| 1890 | 2.09 | 0.55 | 0.74 | 0.75 | 0.00 | 0.00 | 6.47 | 5.58 | 0.97 | *0.77 | 0.83 | 1.48 | 20.33 |
| Means | 1.14 | 1.15 | 0.83 | 0.28 | 0.10 | 0.30 | 2.47 | 2.79 | 1.38 | 0.45 | 0.52 | 0.96 | 12.37 |

*Monthly and annual precipitation at seventy-four stations in Arizona*—Continued.

### MARICOPA, ARIZ.

| Year. | Jan. | Feb. | Mar. | Apr. | May. | June. | July. | Aug. | Sept. | Oct. | Nov. | Dec. | Annual. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1875 | ...... | ...... | ...... | ...... | ...... | ...... | ...... | ...... | ...... | ...... | 0.00 | 0.00 | ...... |
| 1876 | 0.72 | 0.27 | 0.39 | 0.00 | 0.00 | 0.45 | 0.44 | 1.09 | 0.00 | 0.10 | 0.41 | 0.00 | 3.87 |
| 1877 | 0.08 | 1.57 | 0.30 | 0.03 | 0.41 | 0.00 | 1.26 | 0.00 | 1.07 | 0.00 | 0.01 | 1.54 | 6.27 |
| 1878 | 0.00 | 1.01 | ...... | ...... | ...... | ...... | ...... | ...... | ...... | ...... | ...... | ...... | ...... |
| 1879 | ...... | ...... | ...... | ...... | ...... | 0.00 | 0.10 | 1.81 | 0.38 | 0.04 | 0.85 | 0.80 | ...... |
| 1880 | 1.45 | 0.16 | 0.00 | 0.75 | 0.00 | 0.00 | 0.00 | 0.00 | .50 | 0.00 | 0.00 | 0.50 | 3.36 |
| 1881 | 0.00 | 0.00 | 0.88 | 0.00 | 0.00 | 0.00 | 0.00 | 1.47 | 0.50 | 0.00 | 0.00 | 0.00 | 2.85 |
| 1882 | T | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.38 | 0.00 | 0.00 | 0.00 | 0.00 | 0.38 |
| 1883 | 1.34 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.50 | 3.57 | 0.30 | 0.00 | 0.00 | 1.96 | 7.67 |
| 1884 | 0.38 | 0.74 | 2.83 | 0.51 | 0.01 | 0.32 | 0.53 | 0.86 | 1.10 | 1.51 | 0.20 | 2.97 | 11.96 |
| 1885 | 0.00 | 0.45 | 0.15 | 0.00 | 0.18 | 0.04 | 0.48 | 0.92 | T | 0.00 | 0.56 | 0.19 | 2.97 |
| 1886 | 1.32 | 1.65 | 1.71 | 0.06 | 0.00 | 0.00 | *0.16 | 0.08 | 0.06 | 0.76 | 0.21 | 0.11 | 6.12 |
| 1887 | 0.00 | 0.17 | T | 0.51 | 0.31 | 0.03 | 0.43 | 0.50 | 1.00 | 0.28 | 1.13 | 0.00 | 4.36 |
| 1888 | 0.00 | 0.12 | 0.48 | 0.00 | 0.00 | 0.00 | 0.80 | 0.22 | 0.35 | 0.52 | 0.75 | 0.70 | 3.94 |
| 1889 | 0.85 | 0.15 | 1.19 | 0.00 | 0.00 | 0.00 | 0.55 | 0.90 | 0.90 | 1.20 | 0.83 | 3.00 | 9.57 |
| 1890 | 0.00 | 0.22 | 1.02 | 0.00 | 0.00 | 0.00 | 0.10 | 4.29 | 0.15 | *0.07 | 0.31 | 2.47 | 8.63 |
| Means | 0.44 | 0.46 | 0.69 | 0.14 | 0.07 | 0.06 | 0.40 | 0.91 | 0.47 | 0.34 | 0.35 | 0.84 | 5.17 |

* Incomplete.

### McDOWELL, FORT, ARIZ.

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1866 | ...... | ...... | ...... | ...... | ...... | ...... | ...... | ...... | 1.63 | 0.25 | 0.06 | 0.10 | ...... |
| 1867 | 0.88 | 0.16 | 2.11 | 0.03 | 0.00 | 0.00 | 2.97 | 1.18 | 1.62 | 0.03 | 0.29 | 5.70 | 14.97 |
| 1868 | 2.70 | 1.60 | 0.70 | [1.00] | 0.00 | 0.00 | 4.50 | 1.70 | 3.01 | T | 0.01 | 0.00 | [15.22] |
| 1869 | 0.64 | 2.60 | 0.00 | 0.15 | T | 0.10 | 0.40 | 1.10 | 0.00 | 0.00 | 2.15 | 0.55 | 7.69 |
| 1870 | T | 0.60 | 0.65 | T | T | 0.70 | 0.90 | 1.98 | 0.22 | 0.40 | 0.00 | T | 5.45 |
| 1871 | 0.25 | 0.40 | 0.00 | 0.40 | T | T | 0.16 | 2.08 | 0.20 | 0.00 | 1.25 | 0.20 | 4.94 |
| 1872 | 0.50 | 0.40 | 0.00 | 0.53 | 0.30 | 0.31 | 9.16 | 7.17 | 0.08 | T | 0.00 | 1.56 | 20.01 |
| 1873 | 0.00 | 1.60 | 0.90 | 0.00 | 0.16 | T | T | 0.56 | 0.00 | T | 0.21 | 4.70 | 8.13 |
| 1874 | 3.10 | 2.86 | 1.06 | 1.30 | 0.30 | 0.00 | 1.31 | 1.99 | 0.05 | 1.11 | 2.76 | 1.00 | 16.84 |
| 1875 | 1.40 | 0.62 | T | 0.10 | T | 0.00 | 0.75 | 0.46 | 1.00 | 0.00 | 0.00 | 0.64 | 4.97 |
| 1876 | 0.70 | 0.10 | 0.40 | T | 0.00 | 1.00 | 3.25 | 1.70 | 0.00 | T | 0.58 | 0.00 | 7.73 |
| 1877 | 1.08 | 2.24 | 0.44 | 0.50 | 1.04 | 0.00 | T | 0.06 | 1.52 | 0.38 | T | 2.12 | 9.38 |
| 1878 | 0.04 | 1.54 | 1.18 | 3.20 | T | T | 0.86 | 1.57 | 0.98 | 0.00 | 0.99 | 1.56 | 11.92 |
| 1879 | 0.50 | 1.22 | 0.60 | 0.20 | 0.00 | 0.00 | T | 0.12 | 0.34 | 0.58 | 2.14 | 2.64 | 8.34 |
| 1880 | 1.56 | 0.38 | 0.50 | 0.38 | 0.00 | T | 0.52 | 0.84 | 0.34 | [0.40] | 0.00 | 1.69 | 6.61 |
| 1881 | T | T | 1.46 | 0.22 | 0.12 | 0.00 | 1.16 | 3.38 | 0.10 | T | 0.80 | T | 7.24 |
| 1882 | 3.22 | 0.58 | 0.00 | T | 0.10 | 0.56 | 0.40 | 1.52 | 1.34 | 0.00 | 1.38 | 0.00 | 9.10 |
| 1883 | 0.59 | 0.78 | 0.42 | 0.00 | 0.28 | 0.04 | 1.12 | 1.76 | 0.32 | 0.30 | 0.06 | 4.22 | 9.89 |
| 1884 | 0.33 | 4.37 | 3.47 | 0.58 | 0.45 | 0.09 | 0.08 | 1.25 | 3.96 | 1.38 | 0.45 | 4.54 | 20.95 |
| 1885 | 0.00 | 2.50 | 0.60 | 0.00 | 0.00 | 0.00 | 0.00 | 0.90 | 0.90 | 0.40 | 1.75 | 1.25 | 8.30 |
| 1886 | 3.35 | 1.60 | 1.50 | T | 0.00 | [0.00] | 0.00 | 0.62 | T | 0.27 | 0.44 | 0.30 | [8.08] |
| 1887 | 0.00 | 0.86 | 0.00 | 0.68 | T | 0.00 | 0.06 | 1.54 | 4.11 | 0.48 | 1.82 | 0.77 | 10.32 |
| 1888 | 0.87 | 0.72 | 0.62 | 0.14 | 0.40 | 0.00 | 0.86 | 0.17 | 0.35 | 2.82 | 1.49 | 3.47 | 11.91 |
| 1889 | 2.85 | 0.77 | 0.14 | 0.09 | 0.00 | 0.06 | 0.62 | 0.29 | 0.61 | 1.31 | 0.73 | 5.31 | 12.78 |
| 1890 | 0.89 | 1.37 | 0.96 | 0.55 | 0.00 | 0.00 | 1.10 | 1.55 | 0.26 | *1.07 | ...... | ...... | ...... |
| Means | 1.06 | 1.24 | 0.74 | 0.42 | 0.13 | 0.12 | 1.26 | 1.48 | 0.94 | 0.42 | 0.81 | 1.76 | 10.38 |

### McPHERSON, CAMP, ARIZ.

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1867 | ...... | ...... | ...... | ...... | 0.13 | 0.00 | 2.81 | 1.23 | [0.93] | 0.02 | 0.98 | 4.09 | ...... |
| 1868 | 3.12 | 2.27 | 1.55 | 1.40 | 0.63 | 0.00 | 7.24 | 8.30 | 0.93 | 0.70 | 0.75 | ...... | ...... |
| Means | ...... | ...... | ...... | ...... | 0.38 | 0.00 | 5.02 | 4.76 | 0.93 | 0.36 | 0.86 | ...... | 24.74 |

### MOJAVE, FORT, ARIZ.

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1869 | 0.30 | 1.10 | 0.15 | T | T | T | 0.00 | T | 0.00 | 0.14 | 0.74 | 0.06 | 2.49 |
| 1870 | T | T | 0.02 | 0.00 | 0.00 | 0.00 | 0.71 | 1.90 | 0.00 | 0.78 | 0.00 | 0.27 | 3.68 |
| 1871 | 0.00 | 0.02 | 0.00 | 4.05 | 0.00 | 0.00 | 0.66 | 0.00 | 0.00 | 0.10 | 0.00 | 0.03 | 4.86 |
| 1872 | 0.00 | 0.10 | 0.00 | 0.20 | 0.00 | 1.00 | 0.00 | 0.90 | 0.00 | 0.00 | 0.00 | 0.10 | 2.30 |
| 1873 | 0.00 | 0.80 | 0.10 | 0.10 | 1.20 | 0.00 | 0.00 | 3.80 | T | 0.00 | 0.50 | 2.80 | 9.30 |
| 1874 | 0.00 | 5.00 | 0.20 | 0.10 | 0.90 | 0.00 | 0.70 | 0.40 | 0.00 | 2.00 | 2.00 | 0.20 | 11.60 |

*Monthly and annual precipitation at seventy-four stations in Arizona*—Continued.

### MOJAVE, FORT, ARIZ.—Continued.

| Year. | Jan. | Feb. | Mar. | Apr. | May. | June. | July. | Aug. | Sept. | Oct. | Nov. | Dec. | Annual. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1875 | 1.90 | 0.00 | 0.40 | 0.10 | T | 0.00 | 0.35 | 0.10 | 0.10 | 0.00 | 0.15 | 0.00 | 3.10 |
| 1876 | 1.90 | 1.25 | 0.60 | 0.10 | 0.00 | 0.00 | 0.86 | 0.19 | 0.33 | 0.01 | 0.00 | 0.00 | 5.24 |
| 1877 | 0.26 | 0.57 | 0.01 | 0.03 | 0.38 | 0.00 | 0.12 | 0.20 | 0.00 | 0.00 | 0.00 | 1.60 | 3,17 |
| 1878 | 0.22 | 2.10 | 0.25 | 0.06 | T | T | T | 0.80 | 0.11 | 0.00 | 0.42 | 0.01 | 3.97 |
| 1879 | 0.30 | 0.80 | 0.00 | 0.08 | 0.00 | 0.00 | T | 0.72 | 0.00 | 0.90 | 0.30 | 0.24 | 3.34 |
| 1880 | 1.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | T | 0.71 | 0.07 | 0.00 | 0.00 | 0.38 | 2.16 |
| 1881 | T | 0.00 | 0.75 | 0.71 | 0.01 | 0.00 | 1.80 | 0.30 | 0.14 | T | 0.00 | 0.00 | 3.71 |
| 1882 | 0.66 | 0.66 | 0.00 | 0.26 | 0.00 | 0.08 | 0.18 | T | ...... | 0.04 | 0.08 | 0.00 | ..... |
| 1883 | 0.16 | 0.54 | 0.50 | 0.22 | 0.02 | 0.07 | 0.15 | T | 0.42 | 0.10 | 0.00 | 1.23 | 3.41 |
| 1884 | 0.00 | 2.80 | 0.64 | 0.67 | 0.29 | 0.00 | T | T | 0.00 | 0.07 | 0.00 | 5.69 | 10.16 |
| 1885 | 0.00 | 0.00 | 0.18 | 0.30 | T | 0.00 | 0.00 | T | 0.00 | T | 1.70 | 0.02 | 2.20 |
| 1886 | 1.50 | 0.36 | 0.92 | 0.84 | 0.00 | 0.00 | T | 1.86 | 0.00 | 0.00 | 0.28 | T | 5.76 |
| 1887 | T | 1.44 | T | 0.50 | 0.25 | T | 0.25 | 1.62 | T | 0.46 | 0.35 | 0.80 | 5.67 |
| 1888 | 0.95 | 0.34 | 1.66 | T | 0.00 | 0.00 | 0.18 | T | 0.00 | 0.86 | 6.16 | 4.20 | 14.35 |
| 1889 | 4.15 | 0.35 | 2.50 | 0.71 | 0.26 | T | T | 0.74 | 0.00 | 0.65 | 0.85 | 11.17 | 21.38 |
| 1890 | 2.80 | 1.10 | 0.76 | 0.00 | 0.00 | 0.00 | 0.00 | 1.50 | ...... | ...... | ...... | ...... | ...... |
| Means | 0.74 | 0.88 | 0.44 | 0.41 | 0.15 | 0.05 | 0.28 | 0.68 | 0.06 | 0.29 | 0.64 | 1.37 | 5.99 |

### NATURAL BRIDGE, ARIZ.

| Year. | Jan. | Feb. | Mar. | Apr. | May. | June. | July. | Aug. | Sept. | Oct. | Nov. | Dec. | Annual. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1890 | *4.00 | 3.50 | 2.40 | 1.00 | 0.01 | 0.01 | 2.66 | 4.16 | 3.37 | 1.46 | 3.50 | 4.38 | 30.45 |

### NEW RIVER, ARIZ.

| Year. | Jan. | Feb. | Mar. | Apr. | May. | June. | July. | Aug. | Sept. | Oct. | Nov. | Dec. | Annual. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1889 | ...... | ...... | ...... | 0.00 | T | T | ...... | 1.31 | 0.05 | 1.70 | [0.50] | [6.00] | ...... |
| 1890 | ...... | ...... | ...... | 0.37 | 0.00 | 0.000 | 2.30 | 1.69 | 0.29 | *3.27 | 1.77 | 4.30 | ...... |
| Means | ...... | ...... | ...... | 0.18 | ...... | ...... | ...... | 1.50 | 0.17 | ...... | ...... | ...... | ...... |

### ORO (CLIFTON), ARIZ.

| Year. | Jan. | Feb. | Mar. | Apr. | May. | June. | July. | Aug. | Sept. | Oct. | Nov. | Dec. | Annual. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1889 | ...... | ...... | ...... | ...... | ...... | ...... | [2.00] | [0.80] | 1.71 | 1.22 | 0.67 | 0.55 | ...... |
| 1890 | 1.23 | 0.21 | 0.48 | 0.47 | 0.18 | 0.00 | *2.56 | 4.93 | 2.04 | 1.80 | 0.53 | 1.51 | 15.94 |
| Means | ...... | ...... | ...... | ...... | ...... | ...... | ...... | ...... | ...... | ...... | ...... | ...... | 9.52 |

### PANTANO, ARIZ.

| Year. | Jan. | Feb. | Mar. | Apr. | May. | June. | July. | Aug. | Sept. | Oct. | Nov. | Dec. | Annual. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1880 | ...... | ...... | ...... | ...... | ...... | ...... | ...... | ...... | ...... | 0.00 | 0.00 | 0.70 | ...... |
| 1881 | 0.08 | 0.00 | 1.22 | 0.73 | 0.60 | 0.00 | 4.52 | 2.72 | 3.30 | 2.48 | 0.00 | 0.00 | 15.65 |
| 1882 | 2.12 | 2.80 | 0.65 | 0.00 | 0.60 | 0.90 | 1.77 | 5.74 | 0.00 | 0.00 | 1,15 | 0.00 | 15.73 |
| 1883 | 1.84 | 0.41 | 1.61 | 0.00 | 0.30 | 0.45 | 1.77 | 2.06 | 0.06 | 0.53 | 0.05 | 0.19 | ...... |
| 1884 | 0.31 | 1.04 | 0.73 | 0.00 | 0.34 | 0.10 | 0.40 | 2.60 | 1.45 | 2.80 | 0.85 | 4.70 | ...... |
| 1885 | 0.00 | 1.10 | 0.78 | 0.05 | 0.20 | 0.99 | 1.57 | 1.63 | 2.08 | 0.00 | 0.00 | 0.56 | 8.96 |
| 1886 | 1.40 | 1.07 | 0.85 | 0.30 | 0.00 | 0.00 | 1.00 | 2.54 | 2.24 | 0.46 | 0.50 | 0.00 | 10.36 |
| 1887 | 0.00 | 1.15 | 0.00 | 0.00 | 0.40 | 0.31 | 1.86 | 2.66 | 1.38 | 0.38 | 0.50 | 1.19 | ...... |
| 1888 | 0.00 | 0.80 | 1.42 | 0.02 | 0.25 | ...... | ...... | ...... | ...... | ...... | 1.83 | 0.50 | ...... |
| 1889 | 1.59 | 0.65 | 2.08 | 0.88 | 0.00 | 1.14 | 3.22 | 2.42 | 2.52 | 0.04 | 0.00 | 0.96 | 15.50 |
| 1890 | 1.97 | 0.75 | 0.15 | 0.79 | 0.00 | 0.00 | 2.49 | 6.30 | 3.97 | *0.75 | 0.00 | 1.54 | 18.71 |
| Means | 0.93 | 0.98 | 0.95 | 0.22 | 0.27 | 0.39 | 2.01 | 2.80 | 1.63 | 0.74 | 0.49 | 0.88 | 12.29 |

### PAYSON, ARIZ.

| Year. | Jan. | Feb. | Mar. | Apr. | May. | June. | July. | Aug. | Sept. | Oct. | Nov. | Dec. | Annual. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1889 | ...... | ...... | ...... | ...... | ...... | ...... | 2.40 | 0.50 | 1.15 | 1.90 | [0.00] | 8.43 | 23.09 |
| 1890 | 2.44 | 3.62 | 2.00 | 0.65 | 0.00 | 0.00 | ...... | ...... | *2.04 | 2.06 | 3.80 | 4.13 | ...... |
| Means | ...... | ...... | ...... | ...... | ...... | ...... | ...... | ...... | ...... | ...... | ...... | ...... | ...... |

*Monthly and annual precipitation at seventy-four stations in Arizona*—Continued.

### PHŒNIX, ARIZ.

| Year. | Jan. | Feb. | Mar. | Apr. | May. | June. | July. | Aug. | Sept. | Oct. | Nov. | Dec. | Annual. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1876 | ...... | 0.82 | 0.27 | 0.00 | 0.00 | No record. | | [1.00] | 0.90 | 0.72 | 0.00 | 0.00 | ...... |
| 1877 | 0.60 | 1.63 | 0.31 | 0.00 | 0.00 | 0.00 | [1.00] | 0.02 | 1.11 | 0.04 | 0.03 | 0.43 | [5.17] |
| 1878 | 0.07 | 1.07 | 0.96 | 1.25 | 0.04 | 0.00 | 2.40 | 1.63 | 0.19 | 0.00 | 0.27 | 0.64 | 8.52 |
| 1879 | 0.07 | 0.75 | 0.33 | 0.07 | 0.00 | 0.00 | 0.54 | 0.67 | 0.69 | 0.27 | 1.66 | 1.35 | 6.40 |
| 1880 | 1.16 | 0.38 | 0.26 | 0.15 | 0.00 | 0.49 | 1.18 | 0.72 | 0.67 | 0.20 | 0.00 | 1.61 | 6.82 |
| 1881 | 0.00 | 0.20 | 1.46 | 1.10 | 0.12 | 0.00 | 2.03 | 2.19 | 1.04 | 0.25 | 0.36 | 0.16 | 8.91 |
| 1882 | 1.62 | 0.17 | 0.00 | 0.00 | 0.00 | 0.37 | 0.32 | 1.81 | 1.25 | 0.10 | 1.30 | 0.00 | 6.94 |
| 1883 | 0.83 | 1.27 | 1.16 | T | 0.44 | 0.00 | 0.07 | 0.07 | 0.00 | 0.20 | 0.00 | 3.36 | 7.40 |
| 1884 | 0.16 | 2.46 | 2.14 | 0.40 | 0.01 | 0.15 | 0.07 | 1.84 | 1.50 | 1.12 | 0.24 | 2.74 | 12.83 |
| 1885 | 0.00 | 0.47 | 0.33 | 0.00 | 0.65 | 0.04 | 0.18 | 0.71 | 0.07 | 0.09 | 0.91 | 0.32 | 3.77 |
| 1886 | 1.32 | 1.25 | 1.86 | 0.29 | 0.00 | 0.00 | 0.05 | 0.59 | 0.45 | 0.58 | 0.32 | 0.07 | 5.78 |
| 1887 | 0.00 | 0.28 | T | 0.75 | 0.06 | 0.00 | ...... | ...... | ...... | ...... | ...... | [0.50] | ...... |
| 1888 | ...... | ...... | ...... | 0.01 | 0.30 | 0.00 | 0.13 | 0.27 | 0.23 | [2.80] | 1.10 | [3.00] | ...... |
| 1889 | ...... | ...... | ...... | ...... | 0.00 | 0.12 | 0.66 | 1.77 | 0.39 | 0.99 | 0.77 | 3.38 | ...... |
| 1890 | 0.95 | 0.52 | 1.18 | 0.51 | 0.00 | ...... | ...... | ...... | ...... | ...... | ...... | ...... | ...... |
| Means | 0.56 | 0.87 | 0.67 | 0.32 | 0.12 | 0.09 | 0.72 | 1.02 | 0.65 | 0.57 | 0.54 | 1.25 | 7.38 |

### PEORIA, ARIZ.

| Year. | Jan. | Feb. | Mar. | Apr. | May. | June. | July. | Aug. | Sept. | Oct. | Nov. | Dec. | Annual. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1889 | 1.56 | 0.24 | 1.00 | 0.01 | T | T | 1.75 | 2.80 | 0.90 | 1.33 | 0.47 | 3.73 | 13.79 |
| 1890 | 0.70 | ...... | ...... | ...... | ...... | ...... | ...... | ...... | ...... | ...... | ...... | ...... | ...... |
| Means | 1.13 | ...... | ...... | ...... | ...... | ...... | ...... | ...... | ...... | ...... | ...... | ...... | 13.36 |

### RED ROCK, ARIZ.

| Year. | Jan. | Feb. | Mar. | Apr. | May. | June. | July. | Aug. | Sept. | Oct. | Nov. | Dec. | Annual. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1889 | ...... | ...... | ...... | ...... | ...... | ...... | 2.54 | 1.99 | 1.04 | 0.00 | [0.50] | 1.05 | ...... |
| 1890 | 1.05 | [0.60] | 0.50 | 0.25 | 0.00 | 0.00 | ...... | ...... | ...... | *2.91 | ...... | 0.80 | ...... |
| Means | ...... | ...... | ...... | ...... | ...... | ...... | ...... | ...... | ...... | ...... | ...... | ...... | 8.92 |

### RENO, CAMP, ARIZ.

| Year. | Jan. | Feb. | Mar. | Apr. | May. | June. | July. | Aug. | Sept. | Oct. | Nov. | Dec. | Annual. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1868 | ...... | 1.80 | 4.00 | 2.70 | ...... | ...... | ...... | ...... | ...... | ...... | ...... | ...... | ...... |
| 1869 | 2.62 | 3.52 | 0.88 | 0.03 | T | 0.50 | [0.00] | 0.01 | 0.02 | 1.00 | 3.50 | 0.70 | [12.78] |
| 1870 | 2.30 | 2.00 | ...... | ...... | ...... | ...... | ...... | ...... | ...... | ...... | ...... | ...... | ...... |
| Means | 2.46 | 2.44 | 2.44 | 1.37 | ...... | ...... | ...... | ...... | ...... | ...... | ...... | ...... | 14.44 |

### SAN SIMON, ARIZ.

| Year. | Jan. | Feb. | Mar. | Apr. | May. | June. | July. | Aug. | Sept. | Oct. | Nov. | Dec. | Annual. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1881 | ...... | ...... | ...... | ...... | ...... | ...... | ...... | ...... | ...... | ...... | ...... | 0.04 | ...... |
| 1882 | 0.12 | 0.24 | 0.44 | 0.03 | 0.59 | 0.21 | 0.50 | 3.60 | 0.27 | 0.00 | 0.30 | 0.20 | 6.50 |
| 1883 | 0.50 | 0.35 | 0.86 | 0.00 | 0.00 | 0.00 | 1.25 | 2.54 | 0.70 | 0.15 | 0.35 | 0.45 | 7.15 |
| 1884 | 0.40 | 0.60 | 2.21 | 0.00 | 0.34 | 0.08 | 1.21 | 2.47 | 0.40 | 1.63 | 0.00 | 1.03 | 10.37 |
| 1885 | 0.16 | 0.05 | 0.20 | 0.00 | 0.10 | 0.01 | 0.07 | 0.50 | 0.00 | 0.00 | [0.50] | [0.80] | [2.39] |
| 1886 | 0.10 | 0.20 | 0.00 | 0.00 | 0.00 | 0.00 | [0.25] | 0.71 | 0.09 | 0.05 | 0.32 | 0.30 | [2.02] |
| 1887 | 0.01 | 0.78 | 0.00 | 0.10 | 0.00 | 0.00 | 0.00 | 0.00 | 0.10 | 0.00 | 0.00 | 0.00 | 0.99 |
| 1888 | 0.00 | 0.00 | ...... | ...... | 0.00 | 0.00 | ...... | ...... | 0.00 | ...... | ...... | ...... | [4.55] |
| 1889 | ...... | ...... | ...... | T | 0.00 | ? | ...... | ...... | ...... | ...... | ...... | 0.27 | ...... |
| 1890 | 0.84 | T | 0.00 | 0.00 | 0.00 | 0.00 | 1.67 | 2.46 | 1.62 | *0.07 | 0.50 | 1.27 | 8.43 |
| Means | 0.27 | 0.28 | 0.53 | 0.02 | 0.11 | 0.04 | 0.55 | 1.64 | 0.22 | 0.30 | 0.24 | 0.39 | 4.59 |

### SIMMONS, ARIZ.

| Year. | Jan. | Feb. | Mar. | Apr. | May. | June. | July. | Aug. | Sept. | Oct. | Nov. | Dec. | Annual. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1890 | *1.00 | 0.45 | 0.23 | 0.08 | 0.00 | 0.00 | 0.10 | 1.43 | 0.13 | 0.30 | 0.41 | 0.44 | 4.57 |

### SPRINGERVILLE, ARIZ.

| Year. | Jan. | Feb. | Mar. | Apr. | May. | June. | July. | Aug. | Sept. | Oct. | Nov. | Dec. | Annual. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1890 | *1.75 | 0.75 | 0.25 | 0.50 | 0.25 | 0.50 | 2.00 | 2.50 | 1.00 | 0.25 | 1.65 | 1.45 | 12.85 |

*Monthly and annual precipitation at seventy-four stations in Arizona*—Continued.

### SAN CARLOS, ARIZ.

| Year. | Jan. | Feb. | Mar. | Apr. | May. | June. | July. | Aug. | Sept. | Oct. | Nov. | Dec. | Annual. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1881 | ...... | ...... | ...... | ...... | ...... | 0.00 | 4.13 | 5.93 | 1.94 | 0.93 | 0.06 | 0.52 | ...... |
| 1882 | 1.24 | 0.93 | 0.55 | 0.00 | 0.71 | 1.09 | 1.98 | 6.05 | 0.58 | 0.00 | 1.58 | 0.66 | 15.37 |
| 1883 | 1.60 | 2.07 | 0.71 | 0.00 | 0.53 | 0.00 | 2.48 | 1.11 | 0.11 | 1.13 | 0.00 | 2.47 | 12.21 |
| 1884 | 1.00 | 3.83 | 3.97 | 0.84 | 0.32 | 0.49 | 0.37 | 1.24 | 0.83 | 1.49 | 0.55 | 5.48 | 20.41 |
| 1885 | 0.05 | 1.39 | 1.28 | 0.03 | 0.22 | 0.47 | 1.25 | 1.22 | 0.34 | 0.34 | 0.70 | 0.90 | 8.19 |
| 1886 | 2.88 | 1.29 | 0.82 | 0.14 | 0.00 | 0.00 | 0.03 | 3.49 | 0.87 | 0.46 | 0.46 | 0.00 | 10.44 |
| 1887 | T | 1.12 | 0.00 | 0.23 | 0.06 | 0.31 | 2.49 | 1.56 | 0.88 | 0.08 | [0.50] | 1.45 | [8.68] |
| 1888 | 0.52 | 1.03 | 1.93 | 0.00 | 0.10 | 0.00 | 2.10 | 0.40 | 0.63 | 1.73 | 1.76 | 2.84 | 13.04 |
| 1889 | 1.62 | 1.33 | 2.15 | 0.25 | 0.00 | T | 1.83 | 0.87 | 2.05 | 0.60 | 0.40 | 2.30 | 13.40 |
| 1890 | 2.11 | 1.66 | 1.03 | 1.31 | 0.00 | 0.00 | 2.25 | 3.41 | 0.89 | *1.22 | 2.12 | 2.63 | 17.86 |
| Means | 1.22 | 1.63 | 1.38 | 0.31 | 0.22 | 0.24 | 1.85 | 2.43 | 0.91 | 0.75 | 0.67 | 1.85 | 13.46 |

### SHOW LOW (40 MILES NORTH OF APACHE), ARIZ.

| Year. | Jan. | Feb. | Mar. | Apr. | May. | June. | July. | Aug. | Sept. | Oct. | Nov. | Dec. | Annual. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1888 | ...... | ...... | ...... | ...... | ...... | ...... | T | ...... | ...... | ...... | ...... | ...... | ...... |
| 1889 | ...... | ...... | ...... | ...... | ...... | ...... | ...... | 0.60 | 1.15 | 0.42 | 0.65 | 2.25 | ...... |
| 1890 | 1.85 | 3.10 | 4.50 | 1.40 | 0.00 | 0.00 | 4.28 | 3.60 | 1.65 | *1.10 | 1.85 | 2.80 | 26.13 |
| Means | ...... | ...... | ...... | ...... | ...... | 2.14 | 2.10 | 1.40 | ...... | ...... | ...... | ...... | 19.81 |

### SIGNAL, ARIZ.

| Year. | Jan. | Feb. | Mar. | Apr. | May. | June. | July. | Aug. | Sept. | Oct. | Nov. | Dec. | Annual. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1889 | ...... | ...... | ...... | ...... | T | 0.06 | T | 0.98 | 0.42 | 0.56 | T | 5.63 | ...... |
| 1890 | 0.77 | 1.31 | 0.46 | 0.16 | 0.00 | 0.00 | 0.94 | 3.17 | 0.19 | *1.49 | 0.46 | 1.08 | 10.03 |
| Means | ...... | ...... | ...... | ...... | T | 0.03 | 0.47 | 2.07 | 0.30 | ...... | ...... | ...... | 11.76 |

### SILVER KING, ARIZ.

| Year. | Jan. | Feb. | Mar. | Apr. | May. | June. | July. | Aug. | Sept. | Oct. | Nov. | Dec. | Annual. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1889 | ...... | ...... | ...... | ...... | ...... | ...... | 1.88 | 2.78 | 0.97 | 1.17 | 0.83 | 5.22 | ...... |
| 1890 | 3.77 | 2.93 | 0.64 | [0.60] | 0.00 | [0.00] | ...... | ...... | ...... | ...... | ...... | ...... | ...... |
| Means | ...... | ...... | ...... | ...... | ...... | ...... | ...... | ...... | ...... | ...... | ...... | ...... | 20.79 |

### STRAWBERRY, ARIZ.

| Year. | Jan. | Feb. | Mar. | Apr. | May. | June. | July. | Aug. | Sept. | Oct. | Nov. | Dec. | Annual. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1889 | ...... | ...... | ...... | ...... | 0.00 | 0.20 | 2.10 | 1.41 | 3.50 | 2.74 | 0.20 | 12.38 | ...... |
| 1890 | 3.35 | [3.60] | 1.88 | 0.40 | [0.00] | 0.18 | 3.13 | 3.27 | 3.19 | *1.83 | 2.90 | 4.99 | ...... |
| Means | ...... | ...... | ...... | ...... | 0.00 | 0.19 | 2.61 | 2.34 | 3.34 | ...... | ...... | ...... | 33.03 |

### STANWIX, ARIZ.

| Year. | Jan. | Feb. | Mar. | Apr. | May. | June. | July. | Aug. | Sept. | Oct. | Nov. | Dec. | Annual. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1875 | ...... | ...... | ...... | ...... | ...... | ...... | ...... | ...... | ...... | ...... | 0.00 | 0.02 | ...... |
| 1876 | 0.65 | 0.69 | 0.01 | 0.00 | 0.00 | 0.00 | [0.00] | [0.00] | 0.00 | 0.00 | 0.06 | 0.00 | [1.41] |
| 1877 | 0.54 | 2.44 | 0.05 | 0.00 | 0.29 | 0.00 | 0.13 | 0.03 | 0.49 | 0.00 | 0.00 | ...... | ...... |
| Means | 0.60 | 1.56 | 0.03 | 0.00 | 0.14 | 0.00 | 0.06 | 0.02 | 0.24 | 0.00 | 0.02 | 0.01 | 2.68 |

### TEMPE, ARIZ.

| Year. | Jan. | Feb. | Mar. | Apr. | May. | June. | July. | Aug. | Sept. | Oct. | Nov. | Dec. | Annual. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1889 | ...... | ...... | ...... | ...... | ...... | ...... | ...... | ...... | ...... | ...... | 0.97 | 3.64 | ...... |
| 1890 | 0.87 | 0.81 | 0.44 | 0.33 | *0.00 | *0.00 | *1.75 | *1.42 | T | 0.15 | *2.06 | 1.49 | 9.32 |

*Monthly and annual precipitation at seventy-four stations in Arizona*—Continued.

| Year. | Jan. | Feb. | Mar. | Apr. | May. | June. | July. | Aug. | Sept. | Oct. | Nov. | Dec. | Annual. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **TEVISTON, ARIZ.** | | | | | | | | | | | | | |
| 1888 | ...... | ...... | ...... | ...... | ...... | 0.14 | 0.26 | 0.60 | 0.05 | 0.16 | 1.14 | 1.08 | ........ |
| 1889 | 1.20 | 0.80 | 0.80 | 0.20 | 0.00 | 3.80 | 1.80 | 0.10 | 2.30 | 0.60 | 0.20 | 0.20 | 12.00 |
| 1890 | 3.80 | T | 0.20 | 3.00 | 0.00 | 0.00 | 5.20 | 4.00 | 0.12 | *0.00 | 0.00 | 1.70 | 18.17 |
| Means | 2.50 | 0.40 | 0.50 | 1.60 | 0.00 | 1.31 | 2.42 | 1.57 | 0.82 | 0.38 | 0.67 | 0.64 | 12.81 |
| **TEXAS HILL, ARIZ.** | | | | | | | | | | | | | |
| 1879 | ...... | ...... | ...... | ...... | ...... | ...... | ...... | 0.29 | 0.05 | 0.55 | 0.43 | 0.47 | ........ |
| 1880 | 0.23 | 0.00 | 0.00 | 0.06 | 0.00 | 0.00 | 0.00 | 0.00 | 0.35 | 0.00 | 0.00 | 0.34 | 0.98 |
| 1881 | 0.00 | 0.00 | 0.24 | 0.56 | 0.00 | 0.00 | 0.03 | 0.24 | 0.12 | 2.50 | 0.00 | 0.18 | 3.87 |
| 1882 | 1.87 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.53 | [0.00] | 0.05 | 0.12 | 0.00 | [2.57] |
| 1883 | 0.19 | 0.14 | 0.20 | 0.03 | 0.00 | 0.00 | 0.68 | 0.70 | 0.00 | 0.09 | [0.00] | 1.05 | [3.08] |
| 1884 | 0.22 | 1.21 | 1.75 | 0.28 | 0.28 | 0.00 | 0.00 | 0.00 | 0.02 | 0.00 | 0.00 | 1.26 | 5.02 |
| 1885 | 0.00 | 0.04 | 0.02 | 0.00 | 0.00 | 0.00 | 0.00 | 2.25 | 0.00 | 0.00 | 0.32 | 0.00 | 2.63 |
| 1886 | 0.93 | 1.15 | 0.00 | 0.20 | 0.00 | 0.00 | T | 0.95 | 0.00 | 1.50 | 0.00 | 0.00 | 4.73 |
| 1887 | 0.00 | 0.01 | 0.00 | T | 0.00 | 0.00 | T | T | 2.89 | 0.00 | 1.40 | 0.05 | 4.35 |
| 1888 | 0.25 | 0.00 | 0.63 | 0.00 | 0.00 | 0.00 | 0.08 | 0.00 | [0.30] | 1.94 | [0.50] | 1.29 | [4.99] |
| 1889 | 2.65 | 0.00 | 0.12 | 0.00 | 0.00 | 0.00 | T | 0.00 | 0.00 | 0.10 | 0.05 | 0.62 | 3.54 |
| 1890 | 0.00 | 0.40 | 0.00 | 0.00 | 0.00 | 0.00 | 0.10 | [0.50] | 0.10 | *0.03 | 0.10 | 1.28 | 2.86 |
| Means | 0.58 | 0.27 | 0.27 | 0.10 | 0.03 | 0.00 | 0.08 | 0.45 | 0.34 | 0.61 | 0.26 | 0.48 | 3.47 |
| **THOMAS, FORT, ARIZ.** | | | | | | | | | | | | | |
| 1880 | ...... | ...... | ...... | 0.06 | 0.00 | 0.55 | 0.87 | 2.49 | 0.55 | 0 18 | 0.03 | 1.27 | ........ |
| 1881 | 0.03 | 0.13 | 1.21 | 0.63 | 0.07 | 0.00 | 4.18 | 2.49 | 1.55 | 0.40 | 0.32 | 0.40 | 11.41 |
| 1882 | 0.33 | 1.01 | 0.70 | 0.02 | 0.47 | 1.26 | 0.88 | 2.48 | 0.28 | 0.00 | 0.77 | 0.46 | 8.66 |
| 1883 | 1.23 | 1.54 | 1.33 | 0.00 | 0.79 | 0.00 | 1.85 | 2.52 | T | 0.52 | 0.00 | 1.07 | 10.85 |
| 1884 | 0.45 | 2.94 | 3.21 | 0.72 | 0.60 | 0.52 | 0.36 | 2.04 | 0.91 | 0.69 | 0.56 | 5.16 | 18.16 |
| 1885 | 0.03 | 1.00 | 0.75 | 0.14 | 0.09 | 0.18 | 2.93 | 2.46 | 0.02 | 0.01 | 0.38 | 0.71 | 8.70 |
| 1886 | 2.16 | 1.40 | 0.44 | 0.24 | 0.00 | 0.00 | 0.10 | 4.02 | 1.18 | 1.12 | 0.16 | 0.04 | 10.86 |
| 1887 | 0.09 | 0.84 | 0.00 | 0.31 | 2.73 | 0.35 | 3.78 | 2.53 | 3.87 | 0.28 | 0.52 | 1.05 | 16.35 |
| 1888 | 0.65 | 1.06 | 1.78 | 0.37 | 0.23 | 0.00 | 1.88 | 0.64 | 0.55 | 2.80 | 1.72 | 1.66 | 13.34 |
| 1889 | 1.47 | 1.35 | 0.96 | 0.10 | 0.00 | T | 3.45 | 1.40 | 0.38 | 0.26 | 0.34 | 1.18 | 10.89 |
| 1890 | 1.92 | 0.49 | 0.45 | 1.21 | 0.00 | T | 2.02 | 4.11 | 0.75 | *1.30 | 0.69 | 0.99 | 13.93 |
| Means | 0.84 | 1.18 | 1.08 | 0.35 | 0.45 | 0.26 | 2.03 | 2.31 | 0.93 | 0.63 | 0.48 | 1.30 | 11.84 |
| **TIP TOP, ARIZ.** | | | | | | | | | | | | | |
| 1889 | ...... | ...... | ...... | ...... | ...... | 0.00 | 2.50 | 1.17 | 0.26 | 2.97 | 0.00 | 8.63 | ........ |
| 1890 | 2.15 | 6.06 | 2.41 | 0.56 | 0.00 | 0.00 | 3.20 | 2.46 | 0.41 | *2.36 | 2.90 | 4.34 | ........ |
| Means | ...... | ...... | ...... | ...... | ...... | 0.00 | 2.85 | 1.81 | 0.34 | ...... | ...... | ...... | 27.78 |
| **TUCSON, ARIZ.** | | | | | | | | | | | | | |
| 1875 | ...... | ...... | ...... | ...... | ...... | ...... | ...... | ...... | ...... | ...... | 0.18 | 0.82 | ........ |
| 1876 | 0.37 | 0.25 | 1.22 | 0.00 | 0.00 | 0.29 | 3.71 | 4.19 | 2.28 | 0.96 | 0.75 | 0.00 | 14.02 |
| 1877 | 0.19 | 2.53 | 0.20 | 0.57 | 0.41 | 0.00 | 3.04 | 0.02 | 2.44 | 0.46 | 0.00 | 2.91 | 12.77 |
| 1878 | 0.22 | 1.00 | 1.77 | 0.52 | 0.00 | 0.65 | 5.72 | 4.71 | 0.08 | 0.00 | 1.31 | 0.68 | 16.66 |
| 1879 | 2.02 | 0.94 | 0.83 | 0.02 | 0.00 | 0.01 | 0.84 | 1.76 | 0.74 | 0.94 | 0.60 | 3.31 | 12.01 |
| 1880 | 0.56 | 0.15 | 0.41 | 0.04 | 0.00 | T | 1.62 | 1.28 | 1.89 | 0.09 | 0.00 | 0.57 | 6.61 |
| 1881 | 0.05 | 0.25 | 1.17 | 0.62 | 0.04 | 0.00 | 5.69 | 3.92 | 2.37 | 0.62 | 0.00 | 0.19 | 14.92 |
| 1882 | 1.75 | 1.64 | 0.72 | 0.05 | 0.01 | 0.99 | 2.63 | 6.32 | 0.32 | 0.00 | 1.12 | 0.04 | 15.59 |
| 1883 | 1.27 | 0.51 | 1.14 | T | 0.35 | 0.08 | 2.20 | 1.40 | 0.10 | 0.65 | 0.02 | 0.06 | 7.78 |
| 1884 | 0.83 | 2.59 | 1.91 | 0.17 | 0.23 | 0.23 | 0.32 | 1.15 | 0.30 | 2.24 | 0.34 | 4.72 | 15.03 |
| 1885 | 0.00 | 0.42 | 0.40 | 0.00 | 0.00 | 0.13 | 1.00 | 1.76 | 0.12 | 0.00 | 0.42 | 1.01 | 5.26 |
| 1886 | 1.61 | 0.36 | 0.87 | 0.06 | 0.00 | 0.00 | 1.06 | 2.47 | [1.00] | 0.31 | 0.45 | 0.40 | [8.59] |
| 1887 | 0.00 | 0.85 | 0.00 | 0.38 | 0.32 | 0.26 | 5.08 | 1.25 | 2.08 | 1.72 | 0.74 | 0.27 | 12.95 |
| 1888 | 0.73 | 0.57 | 1.03 | T | 0.32 | 0.55 | 1.58 | 0.92 | 0.10 | 0.78 | 2.06 | 1.96 | 10.60 |
| 1889 | 1.74 | 1.06 | 1.98 | 0.18 | T | 0.30 | 5.66 | 2.06 | 3.12 | 0.36 | 0.32 | 1.59 | 18.37 |
| 1890 | 1.27 | 0.76 | 0.29 | 0.10 | 0.00 | 0.00 | 2.37 | 5.13 | 1.44 | *0.65 | 0.83 | 1.32 | ........ |
| Means | 0.84 | 0.93 | 0.93 | 0.18 | 0.11 | 0.23 | 2.87 | 2.37 | 1.21 | 0.65 | 0.55 | 1.24 | 12.11 |

*Monthly and annual precipitation at seventy-four stations in Arizona*—Continued.

VERDE, FORT, ARIZ.

| Year. | Jan. | Feb. | Mar. | Apr. | May. | June. | July. | Aug. | Sept. | Oct. | Nov. | Dec. | Annual. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1868 | ...... | 0.57 | ...... | ...... | ...... | ...... | ...... | ...... | ...... | ...... | ...... | 0.27 | ...... |
| 1869 | 0.34 | 1.72 | 1.00 | 0.09 | 0.03 | 0.83 | 0.07 | 7.26 | 0.00 | 0.02 | 4.04 | 0.00 | 15.40 |
| 1870 | 0.50 | 0.01 | 0.50 | 0.15 | 0.00 | 0.22 | 3.06 | 0.89 | 0.00 | 0.60 | 0.10 | 0.58 | 6.61 |
| 1871 | 0.20 | 0.00 | 0.04 | 0.73 | 0.00 | 0.00 | 0.84 | 0.26 | 1.00 | 1.10 | 0.39 | 0.26 | 4.82 |
| 1872 | 0.47 | 1.12 | 0.16 | 1.56 | 0.54 | 0.22 | 2.22 | 4.35 | 1.12 | 0.10 | 0.00 | 0.83 | 12.69 |
| 1873 | 0.00 | 1.16 | 0.00 | 0.00 | 0.15 | 0.20 | 0.14 | 2.52 | 0.26 | 0.00 | 0.74 | 3.26 | 8.43 |
| 1874 | 2.65 | 2.05 | 1.05 | 1.48 | 0.08 | 0.00 | 1.88 | 2.48 | 0.00 | 1.45 | 3.52 | 0.66 | 17.30 |
| 1875 | 2.91 | 0.05 | 0.30 | T | 0.06 | 0.00 | 3.33 | 2.01 | 1.35 | 0.00 | 0.65 | 0.13 | 10.79 |
| 1876 | 2.06 | 0.75 | 1.00 | 0.75 | 0.00 | 0.98 | 5.31 | 12.08 | 2.40 | 2.10 | 0.15 | 0.00 | 27.58 |
| 1877 | 0.71 | 0.51 | 0.89 | 0.85 | 1.70 | 0.00 | 0.70 | 0.41 | 2.08 | 0.43 | 0.05 | 2.23 | 10.56 |
| 1878 | 0.14 | 1.12 | 1.84 | 1.75 | 0.16 | 0.06 | 2.10 | 4.60 | 0.98 | 0.00 | 0.36 | 1.24 | 14.35 |
| 1879 | 0.20 | 0.14 | 0.00 | 0.10 | 0.00 | 0.00 | 0.97 | 0.53 | 1.40 | 0.23 | 2.40 | 3.03 | 9.00 |
| 1880 | 1.08 | 0.13 | 0.30 | 0.27 | 0.00 | 0.16 | 1.85 | 0.97 | 0.19 | 0.57 | 0.13 | 1.56 | 7.21 |
| 1881 | 0.07 | 0.12 | 2.64 | 0.97 | 0.07 | T | 1.41 | 7.53 | 1.88 | 0.20 | 0.21 | 0.27 | 15.37 |
| 1882 | 2.72 | 0.93 | 0.01 | 0.03 | 0.19 | 1.35 | 1.25 | 1.18 | 2.16 | 0.25 | 1.73 | 0.07 | 11.87 |
| 1883 | 0.44 | 1.35 | 1.63 | 0.12 | 0.27 | 0.04 | 3.35 | 1.14 | 0.00 | 0.45 | 0.00 | 4.30 | 13.09 |
| 1884 | 0.39 | 3.59 | 3.60 | 1.43 | 0.72 | 0.23 | 0.19 | 1.24 | 0.68 | 0.84 | 0.15 | 4.66 | 17.72 |
| 1885 | 0.00 | 0.80 | 2.25 | 0.69 | 0.19 | 0.05 | 0.84 | 3.01 | 0.03 | 0.61 | 1.88 | 0.52 | 10.87 |
| 1886 | 1.90 | 1.48 | 2.09 | 0.82 | 0.02 | 0.01 | 0.18 | 3.18 | 0.20 | 0.13 | 0.55 | 0.60 | 11.16 |
| 1887 | 0.04 | 0.78 | 0.02 | 0.58 | 0.60 | 0.18 | 3.11 | 2.96 | 4.72 | 0.00 | 1.37 | 0.87 | 15.23 |
| 1888 | 0.96 | 1.56 | 1.78 | 0.43 | 0.96 | 0.00 | 2.21 | 0.73 | 0.56 | 4.47 | 2.80 | 3.15 | 19.61 |
| 1889 | 1.95 | 0.25 | 1.66 | 0.00 | 0.00 | 0.02 | 3.10 | 0.75 | 1.60 | 1.74 | 0.08 | 5.08 | 16.23 |
| 1890 | 1.39 | 1.97 | 1.35 | 0.82 | 0.01 | 0.00 | 1.83 | 2.30 | 0.55 | ...... | ...... | ...... | ...... |
| Means | 0.96 | 0.96 | 1.10 | 0.62 | 0.26 | 0.21 | 1.81 | 2.86 | 1.08 | 0.73 | 1.01 | 1.53 | 13.13 |

WALLEN, CAMP, ARIZ.

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1866 | ...... | ...... | ...... | ...... | ...... | ...... | ...... | ...... | ...... | ...... | ...... | 0.00 | ...... |
| 1867 | 4.60 | 2.44 | 0.60 | T | 0.00 | T | 6.66 | 2.50 | 0.20 | T | T | 0.90 | 17.90 |
| 1868 | 1.10 | 0.50 | 0.30 | 0.50 | 0.10 | 0.03 | 7.90 | 4.20 | 2.00 | T | T | 7.90 | 24.53 |
| 1869 | 1.60 | 1.97 | 0.67 | 0.25 | T | 0.05 | 1.40 | 8.00 | 0.50 | [0.97] | [0.98] | [0.98] | [17.37] |
| Means | 2.43 | 1.64 | 0.52 | 0.25 | 0.03 | 0.03 | 5.32 | 4.90 | 0.90 | 0.32 | 0.33 | 2.44 | 19.11 |

TOMBSTONE, ARIZ.

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1889 | ...... | ...... | ...... | 0.00 | ...... | ...... | 3.59 | 2.03 | ...... | ...... | T | ...... | ...... |
| 1890 | 2.51 | 0.00 | ...... | ...... | 0.00 | 0.00 | 4.14 | 6.26 | 2.96 | ...... | ...... | ...... | ...... |

WALNUT GROVE, ARIZ.

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1889 | ...... | ...... | ...... | ...... | 0.00 | T | 2.10 | 1.65 | 0.06 | [2.50] | 1.00 | 7.55 | ...... |
| 1890 | 0.70 | 4.50 | 1.95 | 0.30 | [0.00] | 0.00 | 2.10 | 4.65 | 0.60 | ...... | ...... | ...... | ...... |
| Means | ...... | ...... | ...... | ...... | 0.00 | T | 2.10 | 3.15 | 0.33 | ...... | ...... | ...... | 24.08 |

WALNUT RANCH, ARIZ.

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1889 | ...... | ...... | ...... | ...... | ...... | ...... | ...... | ...... | ...... | ...... | 0.13 | 0.54 | ...... |
| 1890 | 1.77 | 0.08 | 0.00 | 0.29 | 0.00 | 0.00 | 5.06 | 4.89 | 1.06 | 2.11 | ...... | ...... | ...... |

WICKENBURGH, ARIZ.

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1875 | ...... | ...... | ...... | ...... | ...... | ...... | ...... | ...... | ...... | ...... | 0.07 | 0.20 | ...... |
| 1876 | 2.73 | 0.56 | 0.21 | ...... | ...... | ...... | ...... | ...... | 0.40 | 0.58 | 1.45 | 0.00 | ...... |
| 1877 | 1.00 | 1.13 | 0.26 | 0.45 | 0.47 | 0.00 | 0.19 | 0.05 | 1.06 | 0.00 | 0.00 | 1.74 | 6.35 |
| 1878 | 0.67 | 0.60 | 0.51 | 0.80 | 0.35 | 0.05 | 0.09 | 3.86 | 0.39 | 0.00 | 0.12 | 0.63 | 8.07 |

*Monthly and annual precipitation at seventy-four stations in Arizona*—Continued.

### WICKENBURGH, ARIZ.—Continued.

| Year. | Jan. | Feb. | Mar. | Apr. | May. | June. | July. | Aug. | Sept. | Oct. | Nov. | Dec. | Annual. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1879 | 0.15 | 2.14 | 0.33 | 0.13 | 0.00 | 0.00 | 0.62 | 1.27 | 1.10 | 0.10 | 1.69 | 3.12 | 10.65 |
| 1880 | 1.33 | 0.25 | T | 0.25 | 0.00 | 0.00 | 2.29 | 0.61 | 0.89 | 0.08 | 0.00 | 1.23 | 6.93 |
| 1881 | 0.07 | 0.00 | 1.70 | 0.70 | 0.07 | T | 1.82 | 5.02 | 1.16 | 0.09 | 0.41 | 0.36 | 11.40 |
| 1882 | 1.82 | 0.69 | 0.00 | 0.04 | ...... | ...... | ...... | ...... | ...... | ...... | ...... | ...... | ........ |
| 1883 | ...... | ...... | ...... | ...... | ...... | ...... | ...... | ...... | ...... | 0.22 | 0.00 | 4.06 | ........ |
| 1884 | 0.19 | 4.21 | 3.67 | 1.24 | 0.64 | 0.06 | 0.28 | 1.02 | 0.23 | 0.33 | 0.03 | 5.27 | 17.17 |
| 1885 | T | 0.33 | 0.50 | 0.57 | 0.55 | 0.05 | 0.36 | 2.10 | 0.04 | 0.21 | 1.36 | 2.25 | 8.32 |
| 1886 | 2.73 | ...... | ...... | ...... | ...... | ...... | ...... | ...... | ...... | ...... | ...... | ...... | ........ |
| Means | 1.07 | 1.10 | 0.80 | 0.52 | 0.30 | 0.02 | 0.81 | 1.99 | 0.66 | 0.18 | 0.51 | 1.89 | 9.85 |

### WILLCOX, ARIZ.

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1880 | ...... | ...... | ...... | ...... | ...... | ...... | ...... | ...... | ...... | 0.04 | 0.00 | 0.40 | ........ |
| 1881 | 0.02 | 0.00 | 2.95 | T | 0.00 | [0.00] | 3.97 | 5.17 | 0.00 | 0.00 | 0.00 | 0.00 | [12.11] |
| 1882 | [0.50] | 1.15 | 0.00 | 0.00 | 0.00 | [0.90] | 0.11 | 3.46 | 1.56 | 0.00 | 0.58 | 0.32 | [8.58] |
| 1883 | 1.25 | 0.31 | 0.41 | 0.00 | 0.33 | 0.03 | 1.56 | 3.15 | 0.04 | 0.30 | 0.36 | 0.99 | 8.73 |
| 1884 | 0.80 | 1.61 | 1.75 | 0.00 | 0.00 | 0.04 | 1.17 | 1.54 | 0.14 | 3.59 | 0.25 | 3.49 | 14.38 |
| 1885 | 0.05 | 0.63 | 1.52 | 0.03 | [0.20] | 0.34 | 1.78 | 2.10 | 1.11 | 0.00 | 0.56 | 0.19 | [8.51] |
| 1886 | [3.00] | [1.00] | 0.15 | 0.01 | 0.00 | T | 0.37 | 2.14 | 1.68 | 0.36 | 0.58 | 0.08 | [9.37] |
| 1887 | T | 1.83 | 0.00 | 0.03 | 0.48 | 0.47 | 3.82 | 5.31 | 2.96 | 0.45 | 0.22 | 0.92 | 16.49 |
| 1888 | 0.36 | 1.21 | 1.13 | 0.03 | 0.14 | 0.08 | 3.68 | 0.42 | 0.50 | 1.15 | 1.86 | 1.37 | 11.93 |
| 1889 | 1.31 | 0.90 | 1.06 | 0.04 | 0.00 | 0.13 | 4.91 | 0.97 | 2.91 | 0.83 | T | 0.62 | 13.68 |
| 1890 | 1.61 | 0.35 | 0.22 | 0.63 | 0.00 | 0.14 | 2.64 | 5.20 | 1.97 | ...... | ...... | ...... | ........ |
| Means | 0.89 | 0.90 | 0.92 | 0.08 | 0.12 | 0.21 | 2.37 | 2.70 | 1.21 | 0.67 | 0.44 | 0.84 | 11.35 |

### WILLOW GROVE, CAMP, ARIZ.

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1868 | 0.48 | 0.61 | 0.42 | 0.16 | 0.28 | 0.00 | 4.67 | 2.73 | 0.14 | 0.33 | 0.23 | 0.35 | 10.40 |
| 1869 | 0.48 | 1.15 | ...... | 1.02 | 0.12 | 0.07 | 1.43 | 2.01 | 0.00 | ...... | ...... | ...... | ........ |
| Means | 0.48 | 0.88 | 0.42 | 0.59 | 0.20 | 0.04 | 3.05 | 2.37 | 0.07 | 0.33 | 0.23 | 0.35 | 9.01 |

### WILLIAMS, ARIZ.

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1888 | ...... | ...... | ...... | ...... | 0.14 | 0.00 | 1.35 | 0.14 | 0.14 | 2.30 | 4.60 | 3.80 | ........ |
| 1889 | 0.70 | 1.70 | 0.95 | 0.05 | T | T | 1.45 | 4.00 | 4.13 | 0.30 | [0.50] | 1.80 | [15.58] |
| 1890 | 2.50 | ...... | ...... | ...... | ...... | ...... | ...... | ...... | ...... | ...... | ...... | ...... | ........ |
| Means | 1.60 | 1.70 | 0.95 | 0.05 | 0.07 | T | 1.40 | 2.07 | 2.14 | 1.30 | 2.55 | 2.80 | 16.63 |

### WILLOW SPRINGS, ARIZ.

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1888 | ...... | ...... | ...... | ...... | 0.00 | 0.00 | 3.77 | 1.44 | [0.50] | [1.00] | 1.75 | 3.08 | ........ |
| 1889 | 2.04 | [1.00] | 5.77 | [0.25] | 0.00 | 0.20 | 3.06 | 2.41 | 0.92 | [1.00] | 1.15 | 3.67 | 21.47 |
| 1890 | 2.98 | 1.74 | ...... | ...... | ...... | ...... | ...... | ...... | ...... | ...... | ...... | ...... | ........ |
| Means | 2.51 | 1.37 | 5.77 | [0.25] | 0.00 | 0.10 | 3.42 | 1.92 | 0.71 | 1.00 | 1.45 | 3.38 | 21.88 |

### WHIPPLE BARRACKS (PRESCOTT), ARIZ.

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1865 | ...... | ...... | ...... | ...... | ...... | T | ...... | ...... | ...... | ...... | ...... | ...... | ........ |
| 1866 | ...... | ...... | ...... | ...... | ...... | ...... | ...... | ...... | 3.65 | 0.57 | 0.08 | 0.31 | ........ |
| 1867 | 1.72 | 1.16 | 8.00 | 0.06 | 1.17 | 0.00 | 2.70 | 2.38 | ...... | 0.10 | 0.20 | 2.20 | ........ |
| 1868 | 2.97 | 5.30 | 0.50 | 1.00 | ...... | 0.00 | 6.16 | 2.72 | 0.30 | 0.55 | 1.50 | 4.40 | ........ |
| 1869 | 0.80 | 0.92 | ...... | ...... | ...... | ...... | ...... | ...... | ...... | 1.40 | 1.45 | 0.00 | ........ |
| 1870 | 0.00 | 1.20 | 1.09 | 0.26 | 1.73 | 0.24 | 7.98 | 3.49 | 0.00 | 1.59 | 0.30 | 0.53 | 18.41 |

*Monthly and annual precipitation at seventy-four stations in Arizona*—Continued.

### WHIPPLE BARRACKS (PRESCOTT), ARIZ.—Continued.

| Year. | Jan. | Feb. | Mar. | Apr. | May. | June. | July. | Aug. | Sept. | Oct. | Nov. | Dec. | Annual. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1871 | 0.70 | 1.01 | 0.10 | 1.92 | 0.47 | 0.00 | 4.00 | 1.80 | 1.51 | 1.40 | 0.52 | 0.00 | 13.43 |
| 1872 | 0.50 | 0.80 | 0.12 | 1.62 | 1.47 | 1.24 | 3.74 | 6.25 | 0.04 | 0.24 | 0.00 | 0.64 | 16.66 |
| 1873 | 0.00 | 1.00 | 0.23 | 0.17 | 0.40 | 0.42 | 1.56 | 4.78 | 0.30 | 0.00 | 0.80 | 2.55 | 12.21 |
| 1874 | 5.51 | 5.68 | 3.56 | 1.70 | 0.65 | 0.00 | 5.72 | 1.56 | 0.00 | 0.50 | ...... | ...... | ...... |
| 1875 | ...... | ...... | ...... | ...... | 0.00 | 0.00 | 5.92 | 1.66 | 0.77 | 0.00 | 0.18 | 0.63 | ...... |
| 1876 | 4.60 | 0.01 | 0.83 | 0.51 | 0.52 | 0.25 | 3.28 | 4.51 | 0.72 | 0.93 | 0.00 | 0.00 | 16.16 |
| 1877 | 0.36 | 0.56 | 0.49 | 1.50 | 1.82 | 0.00 | 1.29 | 0.24 | 2.42 | 1.36 | 0.00 | 2.23 | 12.27 |
| 1878 | 0.28 | 2.02 | 0.48 | 2.86 | 0.33 | 0.33 | 0.91 | 6.34 | 0.61 | 0.00 | 0.45 | 1.02 | 15.63 |
| 1879 | 0.91 | 0.94 | 0.05 | 0.03 | 0.00 | 0.05 | 1.87 | 2.20 | 0.68 | 0.37 | 1.58 | 4.21 | 12.89 |
| 1880 | 0.35 | 0.16 | 0.11 | 0.52 | 0.00 | 0.04 | 2.34 | 2.80 | 1.26 | 0.18 | 0.42 | 1.84 | 10.02 |
| 1881 | 0.16 | 0.10 | 2.91 | 0.67 | 0.42 | T | 3.27 | 5.25 | 1.69 | 0.33 | 0.30 | 0.33 | 15.43 |
| 1882 | 2.53 | 2.04 | 0.00 | 0.28 | 0.45 | 0.47 | 1.64 | 3.34 | 2.57 | 0.39 | 1.55 | 0.00 | 15.26 |
| 1883 | 0.31 | 0.63 | 2.33 | 0.86 | 0.15 | 0.09 | 3.20 | 3.26 | 0.33 | 0.43 | T | 4.54 | 16.13 |
| 1884 | 0.25 | 6.55 | 5.51 | 1.62 | 1.45 | 0.32 | 1.33 | 1.57 | 0.99 | 1.42 | 0.16 | 5.58 | 26.75 |
| 1885 | 0.08 | 0.46 | 1.47 | 0.62 | 0.37 | 0.07 | 2.53 | 1.24 | 0.11 | 0.38 | 2.46 | 0.32 | 10.11 |
| 1886 | 5.99 | 1.15 | 3.04 | 1.18 | 0.03 | 0.00 | 0.61 | 4.41 | 0.46 | 0.23 | 1.68 | T | 18.78 |
| 1887 | T | 3.12 | T | 2.57 | 0.43 | 0.57 | 2.64 | 0.71 | 4.88 | 0.05 | 1.57 | 0.82 | 17.36 |
| 1888 | 1.30 | 1.68 | 1.66 | 0.52 | 1.96 | 0.00 | 2.49 | 1.42 | 0.62 | 1.75 | 3.18 | 2.94 | 18.52 |
| 1889 | 1.73 | 1.35 | 2.91 | 0.19 | T | 0.02 | 1.45 | 1.51 | 2.11 | 1.76 | 0.42 | 7.38 | 20.83 |
| 1890 | 2.29 | 3.02 | 1.52 | 0.86 | 0.00 | 0.06 | 2.19 | 2.67 | 1.48 | ...... | ...... | ...... | ...... |
| Means | 1.45 | 1.78 | 1.68 | 0.98 | 0.58 | 0.17 | 3.03 | 2.88 | 1.18 | 0.66 | 0.82 | 1.85 | 17.06 |

### WINSLOW, ARIZ.

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1888 | ...... | ...... | ...... | ...... | ...... | 0.01 | 0.43 | 0.23 | 0.30 | 0.84 | 1.69 | 6.12 | ...... |
| 1889 | [0.50] | 0.60 | 0.60 | 0.02 | 0.00 | 0.85 | 0.55 | 1.10 | 0.31 | 0.42 | 0.00 | 0.87 | [5.82] |
| Means | [0.50] | 0.60 | 0.60 | 0.02 | 0.00 | 0.43 | 0.49 | 0.66 | 0.30 | 0.63 | 0.84 | 3.50 | 8.57 |

### WOOD CAÑON, ARIZ.

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1889 | ...... | ...... | ...... | ...... | ...... | ...... | ...... | ...... | 1.41 | 0.70 | 0.30 | 1.00 | ...... |
| 1890 | 2.70 | 0.90 | 0.00 | 1.00 | ...... | ...... | ...... | 3.63 | 5.80 | ...... | ...... | ...... | ...... |

### YUMA, ARIZ.

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1875 | ...... | ...... | ...... | ...... | ...... | ...... | ...... | ...... | ...... | T | 0.00 | 0.00 | ...... |
| 1876 | 0.44 | 0.46 | 0.04 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.94 |
| 1877 | 0.09 | 1.72 | 0.00 | 0.00 | 0.06 | 0.00 | 0.50 | 0.06 | T | 0.00 | 0.00 | 1.23 | 3.66 |
| 1878 | 0.00 | 0.06 | 0.13 | 0.02 | 0.00 | 0.00 | 0.55 | 1.59 | 0.37 | 0.00 | 0.02 | 0.14 | 2.88 |
| 1879 | 0.59 | 1.21 | 0.48 | 0.15 | 0.00 | 0.00 | 0.00 | 0.00 | 0.11 | 0.33 | 0.15 | 0.27 | 3.29 |
| 1880 | T | T | 0.00 | T | 0.00 | 0.00 | T | T | T | T | 0.00 | 0.74 | 0.74 |
| 1881 | 0.00 | 0.00 | T | 0.55 | 0.00 | T | 0.20 | 0.08 | 0.05 | T | 0.00 | 0.10 | 0.98 |
| 1882 | 1.35 | 0.01 | 0.00 | 0.00 | 0.00 | 0.05 | 0.20 | 0.03 | 0.04 | 0.01 | 0.09 | 0.00 | 1.78 |
| 1883 | 0.96 | 0.68 | T | T | 0.00 | 0.00 | 0.31 | 0.22 | 0.13 | 0.05 | 0.00 | [1.61] | 3.96 |
| 1884 | T | 1.58 | 1.48 | 0.07 | 0.44 | T | 0.01 | 0.32 | T | T | T | 1.96 | 5.86 |
| 1885 | T | 0.02 | T | 0.07 | T | 0.00 | 0.05 | 0.86 | 0.00 | 0.00 | 1.71 | 0.01 | 2.72 |
| 1886 | 1.06 | 0.08 | 0.33 | 0.31 | 0.00 | 0.00 | T | 2.23 | 0.00 | 1.11 | 0.23 | 0.00 | 5.35 |
| 1887 | 0.00 | T | 0.00 | 0.20 | T | 0.01 | T | T | 1.09 | 0.02 | 2.43 | 0.15 | 3.90 |
| 1888 | 0.18 | 0.05 | 0.05 | T | 0.00 | 0.00 | 0.04 | T | 0.01 | 0.99 | 0.68 | 0.95 | 2.95 |
| 1889 | 1.12 | 0.06 | 0.24 | 0.00 | 0.00 | T | T | 0.25 | 0.00 | 0.59 | T | 2.43 | 4.69 |
| 1890 | T | 0.86 | T | 0.37 | 0.43 | 0.00 | 0.00 | 0.67 | 0.64 | ...... | ...... | ...... | ...... |
| Means | 0.39 | 0.45 | 0.18 | 0.12 | 0.06 | T | 0.13 | 0.40 | 0.13 | 0.21 | 0.35 | 0.64 | 3.06 |

# Appendix No. 9.

## *MEAN MONTHLY AND ANNUAL TEMPERATURE FOR FORTY-NINE STATIONS IN ARIZONA.*

The prefatory note to Appendix No. 8, with reference to interpolated values, applies also to the bracketed figures in the temperature tables. Letters of the alphabet set against the data for any month indicate the number of days missing from the record for that month; thus "*c*" indicates three days missing.

### APACHE, FORT, ARIZ.

| Year. | Jan. | Feb. | Mar. | Apr. | May. | June. | July. | Aug. | Sept. | Oct. | Nov. | Dec. | Annual. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1871 | ...... | ...... | ...... | ...... | ...... | ...... | ...... | ...... | ...... | ...... | 38.6 | 37.2 | ........ |
| 1872 | 33.8 | 40.3 | 45.1 | 50.3 | 64.7 | 73.1 | 73.0 | 71.5 | 65.2 | 55.5 | 40.1 | 39.7 | 54.4 |
| 1873 | 37.1 | 38.2 | 49.6 | 52.7 | 62.3 | 74.3 | 79.4 | 70.6 | 70.0 | 58.9 | 48.1 | 34.0 | 56.3 |
| 1874 | 27.4 | 35.7 | 43.4 | 49.9 | 64.3 | 74.8 | 74.5 | 75.0 | 70.2 | 57.2 | 45.5 | 35.8 | 54.5 |
| 1875 | 35.6 | 38.3 | 41.3 | 54.0 | 66.9 | 74.2 | 73.2 | 72.9 | 66.2 | 60.0 | 43.3 | 36.7 | 55.2 |
| 1876 | 35.9 | 39.1 | 42.4 | 54.8 | 65.5 | 78.0 | 77.9 | 73.3 | 67.7 | 55.8 | 43.6 | 35.7 | 55.8 |
| 1877 | 38.5 | 41.7 | 49.8 | 49.7 | 59.2 | 74.9 | 83.6 | 77.1 | 67.9 | 59.2 | 41.3 | 39.8 | 56.9 |
| 1878 | 36.7 | 40.2 | 46.7 | 53.5 | 65.9 | 76.2 | 74.4 | 73.1 | 63.6 | 54.9 | 44.4 | 33.6 | 55.3 |
| 1879 | 33.3 | 42.6 | 50.6 | 51.8 | 58.5 | 66.1 | 71.8 | 69.8 | 66.9 | 53.7 | 39.9 | 35.5 | 53.4 |
| 1880 | 34.6 | 29.9 | 41.7 | 49.4 | 55.8 | 67.7 | 70.7 | 69.7 | 63.7 | 52.3 | 37.5 | 36.6 | 50.8 |
| 1881 | 33.3 | 40.1 | 41.6 | 53.6 | 59.7 | 69.8 | 72.6 | 68.3 | 60.9 | 53.7 | 37.4 | 38.3 | 52.4 |
| 1882 | 34.5 | 37.5 | 44.0 | 48.6 | 55.8 | 64.8 | 72.1 | 69.8 | 60.9 | 50.2 | 41.9 | 36.0 | 51.3 |
| 1883 | 31.9 | 39.3 | 47.5 | 48.0 | 56.4 | 69.0 | 70.3 | 69.4 | 63.8 | 50.6 | 41.1 | 38.9 | 52.2 |
| 1884 | 34.9 | 40.2 | 42.8 | 47.5 | 55.6 | 63.9 | 73.9 | 67.9 | 61.0 | 56.9 | 44.1 | 33.9 | 51.9 |
| 1885 | 32.5 | 39.6 | 47.1 | 53.3 | 58.7 | 64.9 | 73.0 | 70.5 | 66.0 | 56.3 | 47.5 | 39.6 | 54.1 |
| 1886 | 34.8 | 42.7 | 42.1 | 50.0 | 63.3 | 69.1 | 73.8 | 71.8 | 64.0 | 54.0 | 39.5 | 40.3 | 53.8 |
| 1887 | 36.8 | 41.2 | 49.5 | 51.8 | 61.6 | 71.9 | 72.9 | 71.2 | 66.8 | 55.4 | 46.1 | 33.4 | 54.9 |
| 1888 | 34.6 | 41.6 | 42.8 | 56.6 | 59.8 | 69.4 | 77.0 | [72.0] | *h*69.8 | *b*58.8 | 47.4 | 41.6 | [56.0] |
| 1889 | 35.6 | 38.1 | 46.8 | 55.8 | 62.8 | 71.2 | 76.3 | 75.0 | 66.0 | 58.0 | 43.2 | 46.3 | 56.3 |
| 1890 | 38.4 | 41.4 | 46.7 | 53.4 | 62.0 | 67.3 | ...... | ...... | ...... | ...... | ...... | ...... | ........ |
| **Means** | 34.7 | 39.4 | 45.3 | 51.8 | 61.0 | 70.6 | 74.5 | 74.6 | 65.6 | 55.6 | 42.7 | 37.5 | 54.4 |

### ASH SPRINGS, ARIZ.

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1889 | ...... | ...... | ...... | ...... | ...... | ...... | ...... | ...... | ...... | ...... | ...... | 52.2 | ........ |
| 1890 | 44.0 | 47.8 | 56.0 | 62.0 | 73.6 | 80.1 | 80.0 | 75.6 | 71.2 | ...... | ...... | ...... | ........ |

### BEALE'S SPRINGS, CAMP, ARIZ.

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1873 | ...... | ...... | ...... | 65.0 | 68.0 | 82.8 | 88.4 | 80.2 | 78.6 | 64.7 | 58.9 | 42.9 | ........ |
| 1874 | 46.6 | 42.0 | 48.5 | ...... | ...... | ...... | ...... | ...... | ...... | ...... | ...... | ...... | ........ |
| **Means** | ...... | ...... | ...... | ...... | ...... | ...... | ...... | ...... | ...... | ...... | ...... | ...... | 63.9 |

### BENSON, ARIZ.

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1881 | [43.0] | 44.6 | 52.1 | 70.0 | 84.1 | 86.7 | [87.0] | 81.1 | 71.5 | 69.4 | 53.0 | [50.0] | [66.0] |
| 1882 | 42.1 | 45.7 | 44.0 | 51.4 | 73.0 | 82.0 | 87.4 | 80.3 | 74.8 | 61.3 | 55.8 | 48.9 | 62.2 |
| 1883 | 43.8 | 45.7 | 60.6 | 64.1 | 78.3 | 91.4 | 85.5 | 80.4 | 82.2 | 69.1 | 57.3 | 49.8 | 67.4 |
| 1884 | 45.4 | 54.1 | 57.0 | 64.1 | 75.4 | [85.3] | 92.0 | 84.5 | 76.5 | 70.2 | 56.3 | 48.8 | [67.5] |
| 1885 | 45.2 | 51.8 | 59.4 | 65.4 | 76.3 | 83.2 | 87.7 | 83.0 | 78.1 | 67.6 | 59.4 | 50.4 | 67.3 |
| 1886 | 46.2 | 52.6 | 52.4 | 63.1 | 79.2 | 82.8 | 85.1 | 82.6 | 75.1 | 66.2 | 49.8 | 49.2 | 65.4 |
| 1887 | 45.5 | 49.5 | 60.2 | 64.2 | 75.6 | 85.1 | 82.8 | 81.5 | 78.6 | 61.7 | 53.6 | 40.0 | 64.9 |

*Mean monthly and annual temperature for forty-nine stations in Arizona*—Continued.

BENSON, ARIZ.—Continued.

| Year. | Jan. | Feb. | Mar. | Apr. | May. | June. | July. | Aug. | Sept. | Oct. | Nov. | Dec. | Annual. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1888 | 44.8 | 49.7 | 56.2 | 67.7 | 73.4 | 84.6 | 84.1 | 84.3 | 78.8 | 69.9 | 54.9 | 49.6 | 66.5 |
| 1889 | 45.3 | 48.4 | 61.1 | 70.3 | 77.6 | 86.0 | 87.5 | 87.6 | 76.7 | 65.8 | 54.5 | 50.2 | 67.6 |
| 1890 | 44.5 | 48.5 | 59.6 | 66.2 | 79.0 | 86.3 | ...... | ...... | ...... | ...... | ...... | ...... | ...... |
| Means | 44.6 | 49.1 | 56.3 | 64.6 | 77.2 | 85.3 | 86.6 | 82.8 | 76.9 | 66.8 | 55.0 | 48.5 | 66.1 |

BOWIE, FORT, ARIZ.

| Year. | Jan. | Feb. | Mar. | Apr. | May. | June. | July. | Aug. | Sept. | Oct. | Nov. | Dec. | Annual. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1867 | ...... | ...... | ...... | ...... | ...... | ...... | ...... | 77.7 | 75.2 | 70.7 | 55.0 | 54.4 | ...... |
| 1868 | 42.2 | 48.6 | 53.9 | 62.2 | 67.9 | 81.9 | 76.7 | 78.3 | 72.8 | 68.8 | 53.2 | 52.1 | 63.2 |
| 1869 | 42.6 | 42.7 | 56.5 | 59.6 | 70.5 | 78.8 | 81.2 | 75.5 | 76.7 | 61.8 | 56.8 | 43.6 | 62.3 |
| 1870 | 48.1 | 53.8 | 54.4 | 65.5 | 73.6 | 78.3 | 76.8 | 76.9 | 75.4 | 65.8 | 57.5 | 44.5 | 64.2 |
| 1871 | 46.1 | 49.9 | 56.2 | 61.1 | 72.8 | 82.8 | 80.6 | 79.9 | 75.0 | 65.1 | 53.3 | 49.9 | 64.4 |
| 1872 | 44.7 | 50 5 | 56.2 | 56.5 | 71.1 | 78.8 | 77.6 | 75.6 | 72.3 | 62.2 | 48.8 | 48.9 | 61.9 |
| 1873 | 44.5 | 45.5 | 56.7 | 61.5 | 70.6 | 81.9 | 85.1 | 75.9 | 78.8 | 64.8 | 53.6 | 43.4 | 63.5 |
| 1874 | 45.2 | 41.4 | 48.0 | 54.5 | 72.0 | 83.9 | 78.8 | 79.7 | 76.7 | 66.9 | 55.8 | 45.6 | 62.4 |
| 1875 | 47.7 | 47.9 | 53.1 | 62.2 | 75.3 | 80.6 | 75.5 | 77.6 | 70.0 | 70.0 | 57.3 | 48.1 | 63.8 |
| 1876 | 44.1 | 48.0 | 51.6 | 66.6 | 72.3 | 79.7 | 77.9 | 74.8 | 73.2 | 65.4 | 52.9 | 47.5 | 62.8 |
| 1877 | 49.9 | 49.2 | 60.4 | 58.5 | 67.9 | 84.0 | 85.1 | 84.6 | 77.5 | 63.5 | 50.5 | 43.8 | 64.6 |
| 1878 | 43.1 | 46.6 | 53.2 | 58.6 | 69.2 | 81.3 | 81.9 | 77.2 | 73.4 | 66.8 | 51.4 | 45.0 | 62.3 |
| 1879 | 43.3 | 54.3 | 63.2 | 64.6 | 77.4 | 81.0 | 81.2 | 82.0 | 77.6 | 62.6 | 52.1 | 49.1 | 65.7 |
| 1880 | 47.9 | 43.1 | 52.6 | 62.4 | 73.7 | 81.5 | 78.1 | 77.2 | 73.2 | 63.8 | 50.3 | 46.2 | 62.5 |
| 1881 | 41.7 | 50.7 | 52.9 | 68.2 | 74.1 | 86.3 | 79.9 | 75.9 | 74.1 | 67.2 | 49.4 | 48.4 | 64.1 |
| 1882 | 44.4 | 45.7 | 55.9 | 63.0 | 70.4 | 76.7 | 81.4 | 78.6 | 72.2 | 65.5 | 51.3 | 46.3 | 62.6 |
| 1883 | 41.4 | 43.5 | 54.2 | 60.1 | 70.1 | 83.3 | 78.1 | 77.6 | 74.0 | 63.1 | 54.1 | 47.4 | 62.2 |
| 1884 | 42.3 | 47.0 | 51.8 | 61.4 | 64.5 | 76.5 | 84.1 | 78.7 | 74.7 | 62.9 | 53.5 | 45.0 | 61.9 |
| 1885 | 41.7 | 50.8 | 55.4 | 60.5 | 69.4 | 75.5 | 81.7 | 78.2 | 67.1 | 65.8 | 53.0 | 47.3 | 62.2 |
| 1886 | 37.8 | 46.6 | 48.8 | 57.0 | 74.1 | 78.6 | 81.1 | 75.9 | 69.1 | 58.8 | 47.0 | 51.0 | 60.5 |
| 1887 | 45.8 | 45.9 | 56.9 | 59.2 | 69.2 | 78.8 | 78.1 | 76.4 | 70.8 | 61.3 | 51.8 | 38.5 | 61.1 |
| 1888 | 43.3 | 46.4 | 48.2 | 62.4 | 66.8 | 78.6 | 78.7 | 77.8 | 71.4 | 63.5 | 50.0 | 42.2 | 60.8 |
| 1889 | 38.1 | 43.7 | 50.8 | 64.1 | 70.5 | 78.0 | 79.6 | 79.6 | 67.6 | 62.7 | 48.9 | 51.8 | 61.3 |
| 1890 | 44.8 | 48.2 | 54.2 | 60.9 | 71.4 | 76.6 | ...... | ...... | ...... | ...... | ...... | ...... | ...... |
| Means | 43.9 | 47.4 | 54.1 | 61.3 | 71.1 | 80.1 | 80.0 | 77.9 | 73.4 | 64.7 | 52.5 | 50.0 | 63.0 |

BUCHANAN, FORT, ARIZ.

| Year. | Jan. | Feb. | Mar. | Apr. | May. | June. | July. | Aug. | Sept. | Oct. | Nov. | Dec. | Annual. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1857 | ...... | ...... | ...... | ...... | ...... | ...... | ...... | 78.7 | 77.0 | 65.7 | 48.9 | 39.8 | ...... |
| 1858 | 39.2 | 45.4 | 47.4 | 59.6 | 66.5 | 74.7 | 75.6 | 73.2 | 70.2 | 59.0 | 45.6 | 38.6 | 57.9 |
| 1859 | 40.6 | 46.4 | 46.4 | 53.6 | 66.3 | 80.2 | 72.3 | 74.3 | 70.4 | 61.4 | 49.6 | 37.5 | 58.2 |
| 1860 | 41.6 | 41.2 | 55.5 | 59.7 | 68.2 | 76.2 | 78.0 | 77.0 | 72.6 | 64.0 | 50.0 | 45.3 | 60.8 |
| 1861 | 37.3 | 45.6 | 54.0 | 64.6 | 70.2 | 78.1 | ...... | ...... | ...... | ...... | ...... | ...... | ...... |
| Means | 39.7 | 44.6 | 50.8 | 59.4 | 67.8 | 77.3 | 75.3 | 75.8 | 72.6 | 62.5 | 48.5 | 40.3 | 59.6 |

COLORADO RIVER, CAMP ON, ARIZ.

| Year. | Jan. | Feb. | Mar. | Apr. | May. | June. | July. | Aug. | Sept. | Oct. | Nov. | Dec. | Annual. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1869 | 52.3 | 56.0 | 66.1 | 70.9 | 79.7 | 89.5 | 93.0 | 91.8 | 83.9 | 71.2 | 62.5 | 52.6 | 72.5 |
| 1870 | 5[illegible].9 | 61.7 | 63.3 | 71.6 | 78.8 | 84.4 | 91.5 | 90.3 | 83.5 | 73.0 | 65.2 | 51.4 | 72.6 |
| 1871 | 57.6 | 58.4 | ...... | ...... | ...... | ...... | ...... | ...... | ...... | ...... | ...... | ...... | ...... |
| Means | 55.3 | 58.7 | 64.7 | 71.2 | 79.2 | 87.0 | 92.2 | 91.0 | 83.7 | 72.1 | 63.8 | 52.0 | 72.6 |

CRITTENDEN, CAMP, ARIZ.

| Year. | Jan. | Feb. | Mar. | Apr. | May. | June. | July. | Aug. | Sept. | Oct. | Nov. | Dec. | Annual. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1868 | ...... | ...... | ...... | 64.8 | 69.8 | 83.3 | 80.0 | 77.0 | 77.8 | 62.6 | [51.0] | 42.4 | ...... |
| 1869 | 38.4 | 41.0 | 50.1 | 56.8 | 65.2 | 77.5 | 78.8 | 75.1 | 71.9 | 60.5 | 56.2 | 44.4 | 59.7 |
| 1870 | 45.8 | 49.0 | 53.7 | 64.0 | 73.2 | 77.0 | 73.3 | 71.5 | 70.1 | 60.8 | 51.1 | 39.5 | 60.8 |
| 1871 | 41.6 | 43.6 | 51.3 | 57.1 | 68.9 | 80.1 | 75.5 | 75.7 | 75.0 | 62.8 | 51.1 | 46.7 | 60.8 |
| 1872 | 42.3 | 46.2 | 53.3 | 59.2 | 70.4 | 79.1 | 74.4 | [74.8] | [73.7] | 62.7 | 45.4 | 44.3 | [60.5] |
| 1873 | 42.8 | ...... | ...... | ...... | ...... | ...... | ...... | ...... | ...... | ...... | ...... | ...... | ...... |
| Means | 42.2 | 45.0 | 52.1 | 60.4 | 69.5 | 79.4 | 76.4 | 74.8 | 73.7 | 61.9 | 51.0 | 43.5 | 60.8 |

*Mean monthly and annual temperature for forty-nine stations in Arizona*—Continued.

CASA GRANDE, ARIZ.

| Year. | Jan. | Feb. | Mar. | Apr. | May. | June. | July. | Aug. | Sept. | Oct. | Nov. | Dec. | Annual. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1880 | ...... | ...... | ...... | ...... | ...... | ...... | ...... | ...... | ...... | 72.3 | 58.2 | ...... | ........ |
| 1881 | 49.0 | ...... | ...... | ...... | ...... | 88.9 | 91.1 | 88.4 | 82.8 | 73.1 | 54.7 | 53.2 | ........ |
| 1882 | 45.0 | 51.7 | 60.5 | 69.8 | 82.3 | 86.1 | 96.2 | 82.3 | 87.3 | 68.7 | 60.6 | 52.6 | 70.3 |
| 1883 | 49.2 | 55.4 | 64.9 | 70.7 | 79.1 | 95.8 | 93.4 | 89.5 | 88.7 | 73.7 | 65.5 | 56.0 | 73.4 |
| 1884 | 53.2 | 54.6 | 59.1 | 69.1 | 80.5 | 88.6 | 98.7 | 91.5 | 83.4 | 76.8 | 66.6 | 54.5 | 73.0 |
| 1885 | 49.5 | 56.0 | 67.1 | 71.5 | 80.2 | 91.5 | 94.7 | 94.6 | 88.9 | 78.3 | 67.9 | 56.0 | 74.7 |
| 1886 | 55.3 | 59.8 | 63.3 | 71.8 | 86.7 | 93.5 | 95.5 | 93.2 | 87.1 | 67.8 | 56.7 | 55.9 | 74.0 |
| 1887 | 52.0 | 56.6 | 69.5 | 71.8 | 80.5 | 92.2 | 93.4 | 93.4 | 88.0 | 74.7 | 63.6 | 49.0 | 73.7 |
| 1888 | 46.9 | 59.9 | 58.2 | 72.8 | 81.2 | 88.9 | 93.9 | 93.2 | 87.7 | 78.2 | 69.5 | 56.5 | 73.9 |
| 1889 | 51.0 | 55.5 | 66.5 | 74.2 | 79.1 | 89.6 | 93.0 | 93.7 | 84.7 | 76.7 | 69.6 | 65.9 | 75.0 |
| 1890 | 51.8 | 56.1 | 66.2 | 70.8 | 83.7 | 88.4 | ...... | ...... | ...... | ...... | ...... | ...... | ........ |
| Means | 50.3 | 56.2 | 63.9 | 71.4 | 81.5 | 90.3 | 94.4 | 91.1 | 86.5 | 74.0 | 63.3 | 55.5 | 73.2 |

DATE CREEK, CAMP, ARIZ.

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1867 | ...... | ...... | ...... | ...... | ...... | ...... | ...... | ...... | 79.3 | ...... | ...... | ...... | ........ |
| 1868 | ...... | ...... | ...... | ...... | ...... | ...... | ...... | ...... | ...... | ...... | 50.2 | 45.4 | ........ |
| 1869 | 44.5 | 44.3 | 54.6 | 59.3 | 71.1 | 84.2 | 85.3 | 82.9 | 75.9 | b62.2 | 54.1 | 43.8 | 63.5 |
| 1870 | 45.1 | 51.0 | 50.4 | 63.1 | 73.6 | 83.0 | 84.3 | 82.0 | 75.5 | 65.3 | 56.5 | 43.6 | 64.4 |
| 1871 | 46.3 | 39.6 | 43.3 | [60.3] | [70.8] | 87.3 | 87.4 | 87.7 | 81.0 | 67.9 | 50.1 | 49.1 | [64.2] |
| 1872 | 44.1 | 48.7 | 54.5 | 58.5 | 71.0 | 79.5 | 82.4 | 81.8 | 77.7 | 67.6 | 49.8 | 45.9 | 63.5 |
| 1873 | 46.6 | 42.8 | 57.2 | 60.4 | 67.7 | 81.0 | 87.9 | ...... | ...... | ...... | ...... | ...... | ........ |
| Means | 45.3 | 45.3 | 52.0 | 60.3 | 70.8 | 83.0 | 85.5 | 83.6 | 77.9 | 65.8 | 52.1 | 45.6 | 63.9 |

DEFIANCE, FORT, ARIZ.

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1851 | ...... | ...... | ...... | ...... | ...... | ...... | ...... | ...... | ...... | ...... | ...... | 27.7 | ........ |
| 1852 | ...... | ...... | ...... | ...... | 52.7 | 64.8 | 68.2 | 67.0 | 50.1 | 45.6 | 32.4 | 28.7 | ........ |
| 1853 | 29.5 | 28.1 | 37.6 | 48.2 | 51.6 | 64.9 | 70.5 | 69.0 | 61.4 | 44.2 | 36.4 | 28.6 | 47.5 |
| 1854 | 24.4 | 30.6 | 37.0 | 46.5 | 51.1 | 62.4 | 71.0 | 64.9 | 57.1 | 48.9 | 38.1 | 32.0 | 47.0 |
| 1855 | 24.7 | 33.6 | 40.3 | 45.1 | 49.2 | 68.6 | 67.2 | [63.9] | 61.1 | 49.5 | 35.9 | 29.8 | [47.4] |
| 1856 | 23.7 | 25.5 | 36.4 | 47.4 | 54.8 | 67.3 | 70.0 | 66.0 | 56.7 | 44.0 | 29.4 | 17.2 | 44.9 |
| 1857 | 27.3 | 32.4 | 46.1 | 50.0 | 57.4 | 68.5 | 73.5 | 71.1 | 60.9 | 47.7 | 32.9 | 23.2 | 49.2 |
| 1858 | 13.3 | 31.9 | 39.0 | 48.4 | 56.8 | 66.9 | 70.8 | 66.6 | 61.6 | 47.0 | 36.0 | 21.7 | 46.7 |
| 1859 | 19.6 | 35.1 | 35.9 | 43.5 | 57.6 | 71.4 | 69.5 | 67.2 | 57.4 | 49.0 | [35.3] | 23.1 | [47.0] |
| 1860 | 30.2 | 31.1 | 41.9 | 48.4 | 57.4 | [67.7] | 71.6 | 72.0 | 60.1 | 50.1 | 34.9 | 30.0 | [49.6] |
| 1861 | 23.0 | 32.5 | 40.8 | ...... | ...... | ...... | ...... | ...... | ...... | ...... | ...... | ...... | ........ |
| 1863 | ...... | ...... | ...... | ...... | ...... | ...... | ...... | ...... | ...... | 46.4 | 33.8 | ...... | ........ |
| Means | 24.0 | 31.2 | 39.4 | 47.2 | 54.3 | 66.9 | 70.3 | 67.5 | 58.5 | 47.2 | 34.5 | 26.2 | 47.3 |

EAGLE PASS, ARIZ.

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1888 | ...... | ...... | ...... | ...... | ...... | ...... | ...... | ...... | ...... | ...... | ...... | 41.2 | ........ |
| 1889 | 36.0 | 44.2 | ...... | ...... | 69.2 | ...... | 77.0 | 72.3 | 70.7 | ...... | 40.8 | 44.3 | ........ |
| 1890 | 34.9 | 38.8 | 45.3 | 53.5 | 66.3 | 72.7 | 78.8 | 72.6 | 69.4 | ...... | ...... | ...... | ........ |
| Means | 35.4 | 41.5 | ...... | ...... | 67.7 | ...... | 77.9 | 72.4 | 70.1 | ...... | ...... | 42.8 | ........ |

FLORENCE, ARIZ.

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1875 | ...... | ...... | ...... | ...... | ...... | ...... | ...... | ...... | ...... | ...... | 61.4 | 53.2 | ........ |
| 1876 | 52.1 | 55.5 | 57.8 | 73.2 | 76.6 | 85.7 | 88.8 | 84.4 | 81.2 | 68.8 | 58.3 | 56.7 | 69.9 |
| 1877 | 54.7 | 60.7 | 65.2 | 66.1 | 71.8 | 87.3 | 93.8 | 93.0 | 85.5 | 71.2 | 55.9 | 53.9 | 71.6 |
| 1878 | 50.1 | 53.2 | 60.3 | 65.3 | 74.3 | 82.0 | 90.8 | 87.9 | 78.0 | 70.2 | 57.0 | 46.3 | 68.0 |
| 1879 | 48.2 | 56.1 | 62.8 | 66.6 | 76.7 | 87.6 | 90.4 | 88.7 | 83.1 | 69.5 | 55.9 | 48.4 | 69.5 |
| 1880 | 49.1 | 47.4 | 54.6 | 63.8 | 73.4 | 83.5 | 86.6 | 86.5 | 81.0 | 68.0 | 52.1 | 50.9 | 66.4 |
| 1881 | 45.7 | 54.7 | 54.7 | 68.0 | 74.8 | 83.4 | 87.9 | 84.5 | 77.5 | 67.4 | 52.4 | 52.2 | 66.9 |
| 1882 | 46.4 | 49.5 | 57.3 | 62.1 | 76.2 | 82.2 | ...... | ...... | ...... | ...... | ...... | ...... | ........ |
| 1889 | 47.6 | 51.6 | 60.4 | 69.6 | 75.0 | 83.2 | 89.8 | 88.4 | 77.1 | 68.6 | 57.7 | 54.6 | 68.6 |
| 1890 | 49.4 | 55.0 | 60.0 | 68.0 | 76.2 | 82.2 | 91.2 | 84.4 | 82.6 | ...... | ...... | ...... | ........ |
| Means | 49.2 | 53.7 | 59.2 | 67.0 | 75.0 | 84.1 | 89.7 | 87.6 | 80.5 | 69.1 | 56.3 | 52.0 | 68.6 |

*Mean monthly and annual temperature for forty-nine stations in Arizona*—Continued.

## GOODWIN, CAMP, ARIZ.

| Year. | Jan. | Feb. | Mar. | Apr. | May. | June. | July. | Aug. | Sept. | Oct. | Nov. | Dec. | Annual. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1866 | 45.3 | 53.1 | ...... | 65.0 | ...... | ...... | ...... | ...... | ...... | 70.0 | ...... | 44.5 | ...... |
| 1867 | 45.0 | 48.2 | 53.5 | 66.5 | 73.1 | 81.9 | 86.5 | 84.5 | 80.9 | 70.7 | 56.8 | 53.2 | 66.7 |
| 1868 | 44.7 | 49.4 | 54.7 | 64.4 | 72.0 | 81.7 | 86.8 | 82.0 | 76.3 | 67.0 | 51.0 | 42.2 | 64.4 |
| 1869 | 40.6 | 45.3 | 58.2 | 61.8 | 74.1 | 85.1 | 87.9 | 84.1 | 81.5 | 68.3 | 57.5 | 44.5 | 65.7 |
| 1870 | 47.5 | 53.2 | 58.7 | 69.6 | 80.2 | ...... | ...... | ...... | ...... | ...... | ...... | ...... | ...... |
| Means | 44.6 | 49.8 | 56.3 | 65.5 | 74.8 | 82.9 | 87.1 | 83.5 | 79.6 | 69.0 | 55.1 | 46.1 | 66.2 |

## GRANT, FORT, ARIZ.

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1873 | 49.7 | 51.9 | 62.3 | 61.9 | 70.4 | 81.6 | 88.0 | 78.4 | 75.5 | 63.8 | 51.3 | 47.4 | 65.2 |
| 1874 | 47.2 | 43.6 | 52.5 | 58.6 | 71.8 | 84.1 | 81.0 | 79.7 | 78.0 | 68.9 | 52.4 | 44.4 | 63.5 |
| 1875 | 44.6 | 46.5 | 47.1 | 59.4 | 76.4 | 79.6 | 78.0 | 79.8 | 73.0 | 73.0 | 56.8 | 50.8 | 63.8 |
| 1876 | 46.3 | 53.8 | 53.4 | 67.9 | [70.4] | 79.0 | 77.1 | 78.5 | 72.2 | 63.4 | 53.4 | [47.0] | [63.5] |
| 1877 | 47.0 | 47.9 | 54.2 | 55.0 | 64.3 | 78.7 | 82.3 | 85.7 | 77.2 | 61.8 | 58.8 | 44.3 | 62.7 |
| 1878 | 44.7 | 46.2 | 51.4 | 57.3 | 67.6 | 76.1 | 78.7 | 76.0 | 71.5 | 66.5 | 52.1 | 44.2 | 61.0 |
| 1879 | 45.1 | 52.9 | 60.7 | 61.2 | 69.7 | 76.1 | 79.9 | 79.2 | 75.9 | 62.0 | 49.4 | 45.9 | 63.2 |
| 1880 | 45.9 | 39.0 | 48.3 | 55.9 | 66.9 | 77.9 | 75.8 | 74.0 | 71.5 | 61.0 | 47.4 | 45.3 | 59.1 |
| 1881 | 41.3 | 49.4 | 49.9 | 62.5 | 68.3 | 78.1 | 75.8 | 71.7 | 67.4 | 61.6 | 45.6 | 45.6 | 59.8 |
| 1882 | 41.6 | 43.7 | 51.4 | 56.4 | 65.2 | 72.5 | 77.9 | 72.1 | 67.9 | 59.4 | 50.7 | 44.5 | 58.6 |
| 1883 | 40.5 | 53.9 | 52.2 | 55.7 | 64.5 | 77.7 | 75.1 | 73.8 | 71.7 | 58.2 | 50.0 | 45.1 | 59.0 |
| 1884 | 41.4 | 45.5 | 48.2 | 54.3 | 64.3 | 74.5 | 81.7 | 75.6 | 71.4 | 63.3 | 54.9 | 44.4 | 60.0 |
| 1885 | 41.1 | 45.8 | 53.1 | 57.8 | 65.5 | 71.6 | 77.7 | 75.4 | 72.4 | 65.1 | 54.1 | 47.8 | 60.6 |
| 1886 | 41.0 | 49.8 | 47.5 | 55.3 | 67.9 | [75.0] | [81.0] | 75.1 | 69.4 | 61.2 | 48.3 | 50.8 | [60.2] |
| 1887 | 46.7 | 45.3 | 57.8 | 56.8 | 66.7 | 76.4 | 76.2 | 74.7 | 70.6 | 61.9 | 53.6 | 39.4 | 60.5 |
| 1888 | 43.3 | 47.0 | 48.2 | 61.5 | 64.4 | 75.4 | 79.2 | 79.1 | 72.6 | 64.6 | 50.8 | 44.6 | 60.9 |
| 1889 | 40.0 | 45.4 | 51.8 | 62.6 | 68.6 | 75.6 | 78.8 | 80.0 | 70.2 | 64.6 | 50.2 | 51.6 | 61.6 |
| 1890 | 45.4 | 48.4 | 53.8 | 59.0 | 69.6 | 74.6 | ...... | ...... | ...... | ...... | ...... | ...... | ...... |
| Means | 44.0 | 47.0 | 52.4 | 58.8 | 67.9 | 76.9 | 79.1 | 77.0 | 72.3 | 63.5 | 51.5 | 46.1 | 61.4 |

## GILA BEND, ARIZ.

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1889 | ...... | ...... | ...... | ...... | ...... | ...... | 95.1 | 96.1 | 83.6 | 72.3 | 58.7 | 57.8 | ...... |
| 1890 | 50.6 | 55.9 | 64.0 | 73.3 | 84.0 | 89.8 | 95.8 | 88.4 | 86.9 | ...... | ...... | ...... | ...... |

## OLD CAMP GRANT, ARIZ.

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1860 | ...... | ...... | ...... | ...... | ...... | ...... | ...... | ...... | ...... | ...... | ...... | 48.3 | ...... |
| 1861 | 43.1 | 51.2 | 60.0 | 70.2 | 78.1 | 85.5 | ...... | ...... | ...... | ...... | ...... | ...... | ...... |
| 1866 | ...... | ...... | ...... | ...... | ...... | ...... | ...... | ...... | 76.2 | 67.4 | 53.6 | 43.3 | ...... |
| 1867 | 44.5 | 47.8 | 51.6 | 61.7 | 76.1 | 86.0 | 90.8 | 87.0 | [82.6] | 73.2 | 60.7 | 58.8 | 68.4 |
| 1868 | 52.1 | 56.2 | 59.9 | 67.6 | 73.3 | 85.5 | 84.4 | 81.0 | 78.0 | 71.5 | 55.1 | 47.8 | 67.7 |
| 1869 | 47.6 | 49.6 | 61.2 | 65.3 | 77.2 | 85.9 | 87.3 | 82.2 | 80.0 | 70.8 | 64.6 | 48.2 | 68.3 |
| 1870 | 48.3 | 52.7 | 56.2 | 66.4 | 78.5 | 84.9 | 87.6 | 84.6 | 79.1 | 68.8 | 57.3 | 42.7 | 67.3 |
| 1871 | 45.9 | 48.6 | 57.8 | 63.3 | 76.8 | 86.9 | 87.0 | 90.1 | 86.9 | 72.6 | 58.0 | 51.2 | 68.8 |
| 1872 | 47.6 | 55.9 | 61.0 | 66.0 | 78.7 | 87.2 | 86.1 | 84.3 | 78.4 | 70.3 | 54.9 | 52.7 | 68.6 |
| Means | 47.0 | 51.7 | 58.2 | 65.8 | 77.0 | 86.0 | 87.2 | 84.9 | 80.2 | 70.7 | 57.7 | 49.1 | 68.0 |

## HUACHUCA, FORT, ARIZ.

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1886 | 41.8 | 50.1 | 49.8 | 56.5 | 70.6 | 76.0 | 80.0 | 75.0 | 68.9 | 62.4 | 54.4 | 49.4 | 61.2 |
| 1887 | 46.3 | 44.5 | 50.1 | 54.2 | [70.0] | 82.6 | 80.0 | [76.0] | 69.6 | 61.0 | 54.2 | 37.7 | [60.5] |
| 1888 | 44.8 | 47.6 | 49.0 | 63.1 | 67.2 | 77.6 | 71.5 | 75.8 | 72.4 | 65.9 | 50.7 | 44.8 | 60.9 |
| 1889 | 38.3 | 42.9 | 51.5 | 63.4 | 69.6 | 74.6 | 76.0 | 76.9 | 68.2 | 62.0 | 50.2 | 51.4 | 60.4 |
| 1890 | 42.1 | 43.8 | [53.0] | 60.1 | 71.2 | 75.0 | ...... | ...... | ...... | ...... | ...... | ...... | ...... |
| Means | 42.7 | 45.8 | 50.7 | 59.5 | 69.7 | 77.2 | 76.9 | 75.9 | 69.8 | 62.8 | 52.4 | 45.8 | 60.8 |

*Mean monthly and annual temperature for forty-nine stations in Arizona*—Continued.

### HUACHUCA, MOUNT, ARIZ.

| Year. | Jan. | Feb. | Mar. | Apr. | May. | June. | July. | Aug. | Sept. | Oct. | Nov. | Dec. | Annual. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1888 | ...... | ...... | ...... | ...... | ...... | ...... | ...... | ...... | ...... | ...... | ...... | 38.1 | ...... |
| 1889 | 32.2 | 41.4 | 51.3 | 60.3 | ...... | ...... | ...... | 80.8 | 69.6 | 65.2 | 52.9 | 54.8 | ...... |
| 1890 | 46.8 | 50.8 | 57.8 | 63.6 | 70.4 | 75.3 | 77.4 | 70.6 | 68.8 | ...... | ...... | ...... | ...... |

### HUALPAI, CAMP, ARIZ.*

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1870 | 37.0 | ...... | ...... | 59.4 | 64.3 | 71.8 | 73.8 | 71.4 | ...... | ...... | 48.5 | 35.7 | ...... |
| 1871 | 40.6 | 39.7 | 49.0 | 51.7 | 64.2 | 77.7 | 77.8 | 76.0 | 66.0 | 54.8 | 42.9 | 40.4 | 56.7 |
| 1872 | 37.1 | 43.5 | 46.6 | 48.6 | 62.8 | 71.6 | 75.4 | 72.6 | 64.2 | 55.2 | 45.8 | 38.9 | 55.2 |
| 1873 | 39.3 | 34.0 | 49.1 | 52.6 | 60.7 | 73.8 | ...... | ...... | ...... | ...... | ...... | ...... | ...... |
| Means | 38.5 | 39.1 | 48.2 | 53.1 | 63.0 | 73.7 | 75.7 | 73.3 | 65.1 | 55.0 | 45.7 | 38.3 | 55.7 |

### HOLBROOK, ARIZ.

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1887 | 37.0 | 38.0 | 48.8 | 50.0 | 60.5 | 71.2 | 76.0 | 75.2 | 68.8 | 59.0 | 45.5 | 27.0 | 54.8 |
| 1888 | 27.5 | 41.2 | 42.8 | 57.8 | 61.8 | 72.0 | 77.5 | 74.8 | 72.7 | 60.6 | 46.9 | 38.0 | 56.1 |
| 1889 | 31.7 | 36.4 | 47.8 | 59.5 | 65.4 | 73.0 | 77.3 | 79.2 | 69.6 | 60.4 | 39.5 | 45.0 | 57.1 |
| 1890 | 33.7 | 41.0 | 47.6 | 55.2 | 62.4 | 67.0 | 77.6 | 73.6 | 66.2 | ...... | ...... | ...... | ...... |
| Means | 32.5 | 39.2 | 46.8 | 55.6 | 62.5 | 70.8 | 76.9 | 76.4 | 70.4 | 60.0 | 44.0 | 36.7 | 56.0 |

### LOCHIEL, ARIZ.

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1889 | ...... | ...... | ...... | ...... | ...... | ...... | 84.0 | 76.9 | 65.6 | 60.3 | 47.5 | 50.0 | ...... |
| 1890 | 44.3 | 46.0 | 52.8 | ...... | ...... | 75.6 | 75.2 | 70.5 | 69.2 | ...... | ...... | ...... | ...... |
| Means | 44.3 | 46.0 | 52.8 | ...... | ...... | 75.6 | 79.6 | 73.2 | 67.4 | 60.3 | 47.5 | 50.0 | ...... |

### LOWELL, FORT, ARIZ.

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1866 | ...... | ...... | ...... | ...... | ...... | ...... | ...... | ...... | ...... | ...... | 66.5 | ...... | ...... |
| 1867 | 51.0 | 45.7 | 54.4 | [63.5] | 78.5 | 85.6 | 87.3 | 85.6 | 84.7 | 76.4 | 65.2 | 59.7 | [69.8] |
| 1868 | 48.7 | 56.2 | 62.5 | 70.5 | 73.2 | 85.7 | 88.2 | 84.4 | 81.8 | 73.9 | 56.8 | 49.4 | 69.3 |
| 1869 | 46.6 | 48.6 | 59.8 | 66.0 | 76.1 | 88.6 | 89.0 | 82.9 | 78.9 | 68.6 | 59.0 | 47.6 | 67.6 |
| 1870 | 50.2 | 53.1 | 58.4 | 68.4 | 78.5 | 82.3 | 83.7 | 83.1 | 77.7 | 69.9 | 59.6 | 45.9 | 67.6 |
| 1871 | 51.8 | 51.1 | 58.0 | 62.3 | 78.3 | 89.3 | 87.5 | 86.6 | 85.1 | 72.4 | 58.0 | 55.3 | 69.6 |
| 1872 | 49.3 | 55.6 | 61.7 | 64.0 | 78.6 | 88.2 | 86.0 | 85.4 | 79.9 | 73.5 | 55.5 | 54.9 | 69.4 |
| 1873 | 51.8 | 53.0 | 65.1 | 68.1 | 77.1 | 87.7 | 90.9 | 81.9 | 80.1 | 70.8 | 59.9 | 48.9 | 69.6 |
| 1874 | 53.1 | 48.0 | 54.2 | 60.5 | 74.6 | 84.8 | 84.0 | 82.7 | 83.2 | 71.7 | 57.6 | 48.9 | 66.9 |
| 1875 | 47.8 | 51.8 | 56.0 | 69.3 | 81.7 | 89.2 | 85.7 | 87.3 | 81.3 | 77.0 | 59.2 | 47.4 | 69.5 |
| 1876 | 47.3 | 53.0 | 56.8 | 70.6 | 80.5 | 90.4 | 88.4 | 83.6 | 80.7 | 67.0 | 58.7 | 48.7 | 68.8 |
| 1877 | 50.5 | 56.5 | 63.2 | 64.5 | 74.7 | 87.9 | 92.6 | 90.2 | 80.3 | 65.2 | 52.1 | 47.0 | 68.7 |
| 1878 | 47.4 | 48.6 | 57.2 | 66.5 | 78.3 | [86.2] | 92.7 | 86.0 | 76.5 | 70.9 | 60.1 | 50.8 | [68.4] |
| 1879 | 51.4 | 57.3 | 62.0 | 69.0 | 78.8 | 89.7 | 88.1 | 86.7 | 81.7 | 66.6 | 53.6 | 50.4 | 69.6 |
| 1880 | 46.8 | 44.2 | 55.0 | 63.5 | 75.0 | 88.4 | 85.8 | 81.9 | 78.9 | 64.0 | 49.9 | 48.9 | 65.2 |
| 1881 | 43.5 | 53.4 | 56.0 | 69.4 | 77.0 | 87.3 | 86.4 | 82.7 | 77.0 | 67.0 | 51.0 | 49.9 | 66.7 |
| 1882 | 45.2 | 47.2 | 56.4 | 63.3 | 72.9 | 81.0 | 88.5 | 82.0 | 77.4 | 64.4 | 57.1 | 49.2 | 65.4 |
| 1883 | 42.3 | 47.8 | 55.9 | 62.2 | ...... | ...... | ...... | ...... | ...... | 66.4 | 58.5 | 49.8 | ...... |
| 1884 | 44.8 | 56.8 | 56.3 | 62.0 | ...... | ...... | ...... | ...... | ...... | ...... | ...... | ...... | ...... |
| 1886 | [48.0] | ...... | 56.7 | 65.3 | 80.2 | ...... | 90.1 | 86.4 | 81.1 | 68.8 | 53.8 | 53.1 | ...... |
| 1887 | 49.5 | ...... | ...... | ...... | ...... | ...... | ...... | ...... | ...... | ...... | ...... | ...... | ...... |
| 1889 | 40.9 | [52.0] | 58.6 | 66.2 | 71.5 | 81.2 | 86.6 | 86.4 | 76.3 | 68.8 | 56.2 | 56.6 | [66.8] |
| 1890 | 49.8 | 52.4 | 58.5 | 65.1 | 71.9 | 78.2 | ...... | ...... | ...... | ...... | ...... | ...... | ...... |
| Means | 48.1 | 51.6 | 58.2 | 65.7 | 76.7 | 86.2 | 87.9 | 84.8 | 80.1 | 69.6 | 57.4 | 50.7 | 68.1 |

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* Formerly Fort Tollgate, name changed to Camp Hualpai, August, 1870.

*Mean monthly and annual temperature for forty-nine stations in Arizona*—Continued.

### McDOWELL, FORT, ARIZ.

| Year. | Jan. | Feb. | Mar. | Apr. | May. | June. | July. | Aug. | Sept. | Oct. | Nov. | Dec. | Annual. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1866 | ...... | ...... | ...... | ...... | ...... | ...... | ...... | ...... | 81.1 | 72.5 | 61.5 | 50.8 | ...... |
| 1867 | 51.5 | 51.1 | 56.0 | 70.7 | 80.0 | 90.7 | 94.9 | 92.0 | 88.8 | 74.3 | 61.5 | 58.8 | 72.5 |
| 1868 | 48.8 | 55.6 | 57.4 | [66.8] | 76.0 | 86.6 | 90.4 | 86.1 | 80.6 | 72.5 | 58.0 | 52.8 | 69.3 |
| 1869 | 48.7 | 51.5 | 62.7 | 69.6 | 77.8 | 90.5 | 94.1 | 90.8 | 85.3 | 73.8 | 61.6 | 52.5 | 71.6 |
| 1870 | 52.6 | 57.6 | 60.1 | 71.7 | 81.8 | 86.6 | 90.3 | 89.4 | 83.4 | 73.0 | 62.0 | 47.5 | 71.3 |
| 1871 | 51.2 | 52.7 | 59.4 | 67.8 | 83.2 | 91.5 | 93.1 | 91.4 | 85.8 | 73.4 | 58.8 | 52.2 | 71.7 |
| 1872 | 46.0 | 53.2 | 60.6 | 65.0 | 77.3 | 87.2 | 86.4 | 83.5 | 77.6 | 69.2 | 53.7 | 53.0 | 67.7 |
| 1873 | 50.6 | 50.1 | 61.7 | 64.1 | 76.4 | 88.7 | 95.0 | 88.3 | 85.0 | 71.5 | 64.8 | 52.4 | 70.7 |
| 1874 | 55.9 | 51.6 | 57.6 | 63.2 | 78.4 | 89.7 | [92.9] | 90.3 | 86.3 | 73.1 | 57.7 | 51.8 | [70.7] |
| 1875 | 49.1 | 53.0 | 55.7 | 67.0 | 81.0 | 89.7 | 90.3 | 89.1 | 83.5 | 76.1 | 58.6 | 51.2 | 70.4 |
| 1876 | 47.8 | 53.8 | 57.5 | 70.6 | 79.9 | 91.3 | 90.4 | 85.8 | 83.0 | 71.7 | 58.0 | 51.0 | 70.1 |
| 1877 | 52.1 | 57.8 | 65.7 | 66.2 | 74.1 | [88.1] | 96.6 | 94.0 | 82.1 | 69.2 | 56.0 | 50.3 | [71.0] |
| 1878 | 48.2 | 52.1 | 60.6 | 66.2 | 78.7 | 88.7 | 95.1 | 90.3 | 78.8 | 70.4 | 57.1 | 45.8 | 69.3 |
| 1879 | 48.4 | 60.4 | 68.4 | 72.8 | 80.1 | 90.2 | 96.3 | 96.2 | 83.2 | 72.6 | 56.5 | 50.4 | 73.4 |
| 1880 | 51.1 | 47.8 | 55.2 | 67.2 | 78.7 | 89.4 | 91.6 | 90.9 | 85.7 | [70.0] | 53.0 | 50.2 | [69.2] |
| 1881 | 46.3 | 53.9 | 58.2 | 71.9 | 79.5 | 88.7 | 92.3 | 87.7 | 81.1 | 69.2 | 54.1 | 52.5 | 69.6 |
| 1882 | 46.7 | 50.8 | 60.0 | 65.3 | 77.2 | 85.8 | 95.1 | 89.4 | 80.0 | 68.2 | 56.9 | 51.3 | 68.9 |
| 1883 | 46.7 | 53.0 | 62.6 | 65.7 | 76.4 | 91.8 | 90.8 | 90.3 | 84.6 | 65.8 | 57.5 | 50.6 | 69.6 |
| 1884 | 50.4 | 54.4 | 56.8 | 62.2 | 72.6 | 80.2 | 90.8 | 87.9 | 77.5 | 70.7 | 58.7 | 46.2 | 67.4 |
| 1885 | 47.6 | 52.0 | 62.9 | 67.0 | 76.1 | 83.4 | 92.1 | 91.8 | 82.2 | 72.3 | 58.6 | 49.6 | 69.6 |
| 1886 | 49.6 | 56.1 | 53.2 | 58.0 | 76.1 | ...... | 91.4 | 87.8 | 82.6 | 66.8 | 52.2 | 53.1 | ...... |
| 1887 | 47.6 | 51.0 | 63.3 | 66.0 | 76.0 | 86.4 | 91.3 | 88.8 | 84.4 | 69.8 | 58.0 | 43.7 | 68.9 |
| 1888 | 46.4 | 53.3 | 55.6 | 71.2 | 74.2 | 84.4 | 90.6 | 90.1 | 85.4 | 69.9 | 58.2 | 51.4 | 69.2 |
| 1889 | 46.2 | 51.8 | 59.4 | 67.8 | 74.8 | 84.8 | 91.6 | 93.0 | 81.4 | 70.4 | 56.4 | 55.8 | 69.4 |
| 1890 | 48.0 | 52.8 | ...... | ...... | ...... | ...... | ...... | ...... | ...... | ...... | ...... | ...... | ...... |
| Means | 49.1 | 51.0 | 57.0 | 67.1 | 77.7 | 83.9 | 92.3 | 89.8 | 83.1 | 71.1 | 57.9 | 51.0 | 69.0 |

### McPHERSON, CAMP, ARIZ.

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1867 | ...... | ...... | ...... | ...... | 68.2 | 78.2 | 81.1 | 82.1 | 79.3 | 61.9 | 52.1 | 50.1 | ...... |
| 1868 | 40.9 | 46.8 | 50.1 | 62.1 | 68.6 | 79.2 | 84.1 | 79.6 | 74.9 | 64.5 | 50.2 | 45.4 | 62.2 |
| 1869 | 44.5 | 44.3 | 54.6 | 59.3 | 71.1 | 84.2 | 85.3 | 82.9 | 75.9 | 62.2 | 54.1 | 43.8 | 63.5 |
| 1870 | 45.1 | 51.0 | 50.4 | 63.1 | 73.6 | 83.0 | 84.3 | 82.0 | 75.5 | 65.3 | 56.5 | 43.6 | 64.4 |
| Means | 43.5 | 47.4 | 51.7 | 61.5 | 70.4 | 81.2 | 83.7 | 81.6 | 76.4 | 63.5 | 53.2 | 45.7 | 63.3 |

### MARICOPA, ARIZ.

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1875 | ...... | ...... | ...... | ...... | ...... | ...... | ...... | ...... | ...... | ...... | 55.1 | 45.0 | ...... |
| 1876 | 42.9 | 50.7 | 57.4 | 71.9 | 79.0 | 88.8 | 92.4 | 86.4 | 83.3 | 72.1 | 61.5 | 51.3 | 69.8 |
| 1877 | 49.1 | 52.8 | 65.5 | 66.3 | 74.6 | 88.6 | 93.1 | 88.4 | 80.2 | 66.5 | 52.1 | 48.0 | 68.8 |
| 1878 | 45.0 | 50.8 | ...... | ...... | ...... | ...... | ...... | ...... | ...... | ...... | ...... | ...... | ...... |
| 1883 | ...... | ...... | ...... | ...... | ...... | ...... | ...... | ...... | ...... | ...... | 56.9 | 53.3 | ...... |
| 1884 | 50.6 | 52.7 | 56.4 | 61.3 | 74.1 | 82.5 | 93.6 | 88.5 | 79.8 | 72.1 | 60.6 | 52.2 | 68.7 |
| 1885 | 49.2 | 54.4 | 63.5 | 73.8 | 64.1 | 85.5 | 92.6 | 92.6 | 84.2 | 73.5 | 61.0 | 52.1 | 70.5 |
| 1886 | 51.6 | 58.8 | 57.6 | 65.5 | 83.0 | 87.2 | 96.2 | 92.8 | 84.6 | 69.0 | 54.6 | 55.2 | 71.3 |
| 1887 | 51.4 | 52.6 | 66.2 | 68.2 | 78.1 | 88.4 | 90.8 | | | Discontinued. | | | |
| Means | 48.5 | 53.3 | 61.1 | 67.8 | 75.5 | 86.8 | 93.1 | 89.7 | 82.4 | 70.6 | 57.4 | 51.0 | 69.8 |

### MARICOPA, ARIZ.*

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1879 | ...... | ...... | ...... | ...... | 80.8 | 89.3 | 94.2 | [92.2] | 91.2 | 77.3 | 64.7 | 64.4 | ...... |
| 1880 | 64.7 | [53.0] | 68.4 | 69.7 | 79.2 | [91.6] | 93.3 | 91.8 | 89.9 | 73.0 | 65.8 | 53.1 | [74.5] |
| 1881 | 47.1 | 57.6 | 61.3 | 75.4 | 82.9 | 92.9 | 94.5 | 91.2 | 80.5 | [73.0] | 66.7 | 63.2 | [73.9] |
| 1882 | 58.9 | 59.4 | 65.3 | 70.0 | 77.9 | 85.6 | 98.3 | 90.2 | 82.4 | 67.9 | 56.8 | 48.3 | 71.8 |
| 1883 | 45.8 | 53.3 | 61.2 | 69.1 | 73.6 | 100.4 | 90.7 | 92.8 | 84.1 | 65.5 | 59.2 | 53.0 | 70.7 |
| 1884 | 48.0 | 55.8 | 59.5 | 68.1 | 81.9 | 89.6 | 93.7 | 89.9 | 79.5 | 71.9 | 59.3 | 55.9 | 71.1 |
| 1885 | 52.4 | 56.5 | 64.7 | 70.3 | 83.0 | 90.5 | 93.2 | 92.5 | 86.7 | 75.7 | 64.1 | 54.0 | 73.6 |
| 1886 | 53.4 | 62.4 | 63.0 | 70.1 | 86.8 | 93.2 | 98.9 | 94.2 | 88.3 | 70.7 | 56.4 | 53.7 | 74.3 |
| 1887 | 51.2 | 55.5 | 69.1 | 73.2 | 88.5 | 90.2 | 93.0 | 93.3 | 82.9 | 73.5 | 66.2 | 53.9 | 74.2 |
| 1888 | 65.5 | 61.3 | 64.4 | 77.9 | 87.2 | 91.6 | 94.1 | 93.7 | 88.4 | 71.2 | [60.0] | 56.3 | [76.0] |
| 1889 | 51.2 | 56.0 | 65.5 | 73.9 | 78.2 | 88.8 | 93.7 | 92.8 | 63.6 | 71.5 | 60.2 | 56.8 | 71.0 |
| 1890 | 58.8 | 58.6 | 65.3 | 74.9 | 84.8 | 95.1 | ...... | ...... | ...... | ...... | ...... | ...... | ...... |
| Means | 54.3 | 57.2 | 64.3 | 72.1 | 82.1 | 91.6 | 94.3 | 92.2 | 83.4 | 71.9 | 61.8 | 55.7 | 73.4 |

* Record of Pacific Railway system. Not consolidated with Signal Service record on account of difference of exposure of thermometers.

*Mean monthly and annual temperature for forty-nine stations in Arizona*—Continued.

### MOHAVE, FORT, ARIZ.

| Year. | Jan. | Feb. | Mar. | Apr. | May. | June. | July. | Aug. | Sept. | Oct. | Nov. | Dec. | Annual. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1859 | ...... | ...... | ...... | ...... | ...... | 93.7 | 93.2 | 93.4 | 84.7 | 75.5 | 60.4 | 49.8 | ...... |
| 1860 | 49.8 | 55.3 | 66.7 | 72.8 | 77.6 | 87.6 | 94.2 | 96.5 | 87.2 | 74.9 | 60.3 | 53.9 | 73.1 |
| 1861 | 49.1 | 58.6 | 68.1 | 78.3 | *d*83.4 | ...... | ...... | ...... | ...... | ...... | ...... | ...... | ...... |
| 1865 | ...... | ...... | ...... | ...... | ...... | ...... | ...... | ...... | ...... | 76.7 | 64.0 | 49.2 | ...... |
| 1866 | 52.1 | 58.9 | 62.8 | 71.5 | 82.6 | ...... | ...... | ...... | 8.30 | 73.2 | 59.5 | 54.3 | ...... |
| 1867 | 51.8 | 51.2 | 58.2 | 73.9 | ...... | ...... | ...... | ...... | ...... | ...... |  | 63.6 | ...... |
| 1868 | 51.8 | 58.9 | 64.9 | 74.7 | 77.2 | 86.8 | 93.4 | 90.3 | 86.4 | 76.5 | 62.6 | 56.4 | 73.3 |
| 1869 | 54.7 | 55.9 | 66.4 | 71.7 | 79.6 | 92.4 | 95.9 | 91.9 | 80.9 | 74.5 | 61.7 | 51.7 | 73.1 |
| 1870 | 56.2 | 56.1 | 61.2 | 72.7 | 81.9 | 89.5 | 95.8 | 93.0 | 83.0 | 72.6 | 63.8 | 49.6 | 73.0 |
| 1871 | 55.1 | 55.4 | 64.7 | 68.8 | 81.4 | 92.9 | 96.8 | 95.9 | 87.7 | 73.6 | 58.6 | 55.3 | 73.8 |
| 1872 | 50.2 | 56.8 | 61.3 | 66.2 | 80.5 | 88.5 | 91.7 | 90.9 | 83.7 | 73.1 | 55.4 | 51.4 | 70.8 |
| 1873 | 54.7 | 54.5 | 69.7 | 72.3 | 78.3 | 91.8 | 100.1 | 91.8 | 89.7 | 75.1 | 66.2 | 52.0 | 74.7 |
| 1874 | 56.4 | 53.3 | 62.1 | 72.2 | 83.4 | 92.4 | 99.2 | 96.2 | 90.1 | 78.0 | 62.5 | 54.6 | 75.0 |
| 1875 | 53.2 | 58.6 | 63.1 | 75.5 | 86.8 | 91.4 | 98.8 | 98.8 | 90.2 | 80.0 | 63.4 | 59.2 | 76.6 |
| 1876 | 51.0 | 59.7 | 63.9 | 76.8 | 84.1 | 95.3 | 97.2 | 92.3 | 81.8 | 74.1 | 61.1 | 53.4 | 74.2 |
| 1877 | 55.6 | 61.8 | 70.1 | 70.6 | 78.1 | 90.8 | 98.8 | 94.4 | 85.6 | 71.8 | 61.0 | 52.4 | 74.2 |
| 1878 | 54.0 | 58.0 | 65.1 | 71.6 | 81.2 | 89.1 | 96.2 | 95.9 | 83.6 | 73.0 | 60.2 | 51.7 | 73.3 |
| 1879 | 51.1 | 62.0 | 70.5 | 73.8 | 80.4 | 89.2 | 94.4 | 93.0 | 87.2 | 71.6 | 57.7 | 50.4 | 73.4 |
| 1880 | 51.1 | 51.1 | 58.0 | 69.5 | 79.1 | 87.8 | 92.9 | 90.5 | 83.8 | 71.2 | 53.4 | 53.8 | 70.2 |
| 1881 | 50.0 | 59.4 | 62.7 | 77.1 | 81.2 | 89.2 | 94.5 | 92.8 | 84.1 | 70.9 | 57.1 | 54.1 | 72.8 |
| 1882 | 45.8 | 50.2 | 62.6 | 69.0 | 80.5 | 87.2 | 97.3 | 96.2 | 85.1 | 70.6 | 59.8 | 56.2 | 71.7 |
| 1883 | 49.2 | 54.9 | 68.8 | 68.5 | 77.4 | 92.3 | 95.3 | 95.8 | 87.6 | 68.8 | 62.3 | 54.9 | 73.0 |
| 1884 | 51.7 | 52.5 | 58.6 | 67.3 | 77.0 | 85.5 | 93.4 | 92.2 | [80.0] | 73.3 | 65.6 | 51.9 | [70.8] |
| 1885 | 48.7 | 58.5 | 68.8 | 73.7 | 82.9 | 86.1 | 94.8 | 94.8 | 85.8 | 73.4 | 61.8 | 55.8 | 73.8 |
| 1886 | 53.4 | 61.9 | 59.4 | 68.8 | 83.4 | 88.9 | 96.2 | 94.6 | 88.3 | 68.5 | 55.0 | [53.4] | [72.6] |
| 1887 | [52.0] | 52.6 | 65.8 | 71.2 | 80.6 | 89.5 | 92.7 | 90.0 | 83.8 | 75.3 | 63.0 | 50.5 | [72.2] |
| 1888 | 46.4 | 57.0 | 60.7 | 73.5 | 75.6 | 84.3 | 90.1 | [93.6] | 68.2 | 72.5 | 57.2 | 49.4 | [70.7] |
| 1889 | 46.6 | 52.0 | 62.8 | 69.1 | 78.2 | 87.8 | 94.9 | 93.8 | 82.7 | 71.0 | 55.9 | 52.5 | 70.6 |
| 1890 | 44.0 | 52.8 | 58.7 | 70.0 | 78.4 | 83.4 | ...... | ...... | ...... | ...... | ...... | ...... | ...... |
| Means | 51.3 | 56.2 | 63.9 | 71.9 | 80.4 | 89.3 | 95.3 | 93.7 | 85.4 | 73.4 | 60.4 | 53.4 | 72.9 |

### PANTANO, ARIZ.

| Year. | Jan. | Feb. | Mar. | Apr. | May. | June. | July. | Aug. | Sept. | Oct. | Nov. | Dec. | Annual. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1880 | ...... | ...... | ...... | ...... | ...... | ...... | ...... | ...... | ...... | ...... | ...... | 47.2 | ...... |
| 1881 | 41.2 | 50.6 | 53.6 | 68.4 | 80.7 | 88.7 | 83.0 | [84.0] | 78.4 | 72.0 | 54.8 | 51.5 | [67.2] |
| 1882 | 49.4 | 50.6 | 55.6 | 66.7 | 75.0 | 85.2 | [85.0] | 84.4 | 81.2 | 69.0 | 58.9 | 51.8 | [67.8] |
| 1883 | 44.8 | 50.5 | 62.2 | 65.4 | 73.0 | 86.4 | 86.2 | 80.5 | 79.1 | 66.0 | 61.7 | 52.8 | 67.4 |
| 1884 | 49.4 | 51.1 | 55.0 | 56.2 | 66.1 | [85.5] | 86.3 | 80.8 | 75.7 | 68.5 | 60.4 | 52.0 | [65.6] |
| 1885 | 50.7 | 53.4 | 60.3 | 66.0 | 75.8 | 80.3 | 84.7 | 84.2 | 81.2 | 73.3 | 63.2 | 53.3 | 68.9 |
| 1886 | 53.1 | 54.9 | 56.1 | 65.2 | 84.7 | 92.0 | 88.9 | 84.8 | 83.2 | 72.2 | 67.6 | [50.0] | [71.1] |
| 1887 | [50.0] | [52.0] | 74.7 | 68.9 | [75.0] | 83.3 | 84.7 | 83.4 | 81.2 | 73.0 | 61.6 | 43.7 | [69.3] |
| 1888 | 48.5 | 55.8 | 55.7 | 69.0 | 75.0 | 83.0 | 84.2 | 82.5 | 79.4 | 65.0 | 54.6 | 48.1 | 66.7 |
| 1889 | 40.2 | 42.3 | 56.2 | 68.5 | 76.3 | 83.1 | 86.6 | 87.2 | 70.5 | 65.0 | 55.2 | 53.8 | 65.4 |
| 1890 | 46.6 | 50.7 | 56.5 | 67.0 | 76.6 | 87.9 | ...... | ...... | ...... | ...... | ...... | ...... | ...... |
| Means | 47.4 | 51.2 | 58.6 | 66.1 | 75.8 | 85.5 | 85.5 | 83.5 | 78.9 | 69.3 | 59.8 | 50.4 | 67.7 |

### NEW RIVER, ARIZ.

| Year. | Jan. | Feb. | Mar. | Apr. | May. | June. | July. | Aug. | Sept. | Oct. | Nov. | Dec. | Annual. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1889 | ...... | ...... | ...... | 57.8 | 59.2 | 70.7 | [91.0] | 90.4 | 78.2 | 68.5 | ...... | ...... | ...... |
| 1890 | ...... | ...... | ...... | 65.9 | 72.2 | 77.6 | 88.4 | 82.9 | 79.2 | ...... | ...... | ...... | ...... |

### PHŒNIX, ARIZ.

| Year. | Jan. | Feb. | Mar. | Apr. | May. | June. | July. | Aug. | Sept. | Oct. | Nov. | Dec. | Annual. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1876 | ...... | ...... | ...... | ...... | ...... | ...... | ...... | ...... | 80.8 | 69.5 | 59.5 | 52.2 | ...... |
| 1877 | 51.9 | 58.4 | 66.8 | 68.3 | 70.3 | 83.8 | 92.7 | 90.6 | 80.4 | 67.7 | 54.3 | 50.6 | 69.6 |
| 1878 | 47.0 | 52.4 | 59.8 | 64.5 | 75.8 | 86.5 | 93.7 | 89.8 | 79.3 | 70.3 | 57.0 | 47.6 | 68.6 |
| 1879 | 49.2 | 58.6 | 66.0 | 68.3 | 75.0 | 84.3 | 90.8 | 89.1 | 85.0 | 71.0 | 56.9 | 51.0 | 70.4 |
| 1880 | 51.5 | 49.8 | 57.3 | 66.7 | 77.4 | 88.5 | 90.4 | 89.7 | 84.1 | 68.8 | 52.5 | 50.4 | 68.9 |
| 1881 | 45.5 | 55.4 | 58.4 | 69.3 | 75.6 | 82.9 | 87.7 | 85.1 | 77.1 | 66.5 | 51.7 | 51.5 | 67.2 |
| 1882 | 44.1 | 51.0 | 62.0 | 67.1 | 77.2 | 83.6 | 91.6 | 88.6 | 81.7 | 69.8 | 59.7 | 57.9 | 69.5 |
| 1883 | 47.0 | 52.1 | 64.5 | 62.1 | 71.3 | 85.4 | 89.0 | [88.0] | *h*81.3 | 67.2 | 58.5 | 55.5 | [68.5] |
| 1884 | 50.6 | 52.5 | 54.5 | 63.0 | 71.2 | 89.6 | 87.7 | 83.7 | 73.6 | 72.1 | 61.6 | 51.9 | 66.8 |

*Mean monthly and annual temperature for forty-nine stations in Arizona*—Continued.

### PHŒNIX, ARIZ.—Continued.

| Year. | Jan. | Feb. | Mar. | Apr. | May. | June. | July. | Aug. | Sept. | Oct. | Nov. | Dec. | Annual. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1885 | 50.2 | 54.8 | 59.9 | 65.0 | 68.9 | 71.6 | 82.3 | 83.1 | 79.3 | 70.6 | 56.3 | 53.5 | 66.3 |
| 1886 | 50.4 | 56.9 | 57.4 | 65.0 | 75.1 | 80.4 | 92.0 | 90.0 | [84.0] | [67.0] | [54.5] | 55.3 | [69.0] |
| 1887 | 51.7 | 53.8 | 69.2 | 69.6 | 78.9 | 87.2 | ...... | ...... | ...... | ...... | ...... | ...... | ...... |
| 1888 | ...... | ...... | ...... | 70.9 | 69.8 | 84.0 | 90.8 | 87.9 | 83.1 | ...... | 69.3 | ...... | ...... |
| 1880 | ...... | ...... | ...... | ...... | 78.6 | 86.3 | 92.6 | 91.6 | 80.4 | 70.9 | 57.0 | 56.1 | ...... |
| 1889 | 48.5 | 54.2 | [61.0] | 64.2 | ...... | ...... | ...... | ...... | ...... | ...... | ...... | ...... | ...... |
| Means | 49.0 | 54.2 | 61.4 | 66.5 | 74.2 | 83.4 | 90.1 | 88.1 | 80.8 | 69.3 | 57.6 | 52.8 | 69.0 |

### PEORIA, ARIZ.

| Year. | Jan. | Feb. | Mar. | Apr. | May. | June. | July. | Aug. | Sept. | Oct. | Nov. | Dec. | Annual. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1889 | 47.0 | 51.6 | 60.1 | 69.2 | 76.5 | 84.8 | 91.9 | 92.6 | 82.0 | 70.2 | 55.6 | 54.0 | 69.6 |
| 1890 | 46.3 | ...... | ...... | ...... | ...... | ...... | ...... | ...... | ...... | ...... | ...... | ...... | ...... |
| Means | 46.6 | 51.6 | 60.1 | 69.2 | 76.5 | 84.8 | 91.9 | 92.6 | 82.0 | 70.2 | 55.6 | 54.0 | 69.6 |

### RENO, CAMP, ARIZ.

| Year. | Jan. | Feb. | Mar. | Apr. | May. | June. | July. | Aug. | Sept. | Oct. | Nov. | Dec. | Annual. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1869 | 47.8 | 49.2 | 62.5 | 68.5 | 78.8 | 89.6 | 91.4 | 88.1 | 85.4 | 71.4 | 61.2 | 48.2 | 70.2 |
| 1870 | 48.0 | 52.6 | ...... | ...... | ...... | ...... | ...... | ...... | ...... | ...... | ...... | ...... | ...... |
| Means | 47.9 | 50.9 | ...... | ...... | ...... | ...... | ...... | ...... | ...... | ...... | ...... | ...... | 70.3 |

### SAN CARLOS AGENCY, ARIZ.

| Year. | Jan. | Feb. | Mar. | Apr. | May. | June. | July. | Aug. | Sept. | Oct. | Nov. | Dec. | Annual. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1881 | ...... | ...... | ...... | ...... | ...... | 80.6 | 86.7 | 80.7 | 72.7 | 62.6 | 44.2 | 44.2 | ...... |
| 1882 | 42.7 | 45.8 | 52.6 | 58.0 | 66.2 | 77.4 | 88.2 | 83.1 | 72.0 | 58.8 | 50.2 | 48.5 | 62.0 |
| 1883 | 49.2 | 56.6 | 66.3 | 67.9 | 68.2 | 78.4 | 81.5 | 83.3 | 78.2 | 64.1 | 51.7 | 48.6 | 66.2 |
| 1884 | 44.1 | 50.7 | 53.5 | 59.5 | 68.9 | 78.3 | 81.2 | 86.1 | 74.9 | 67.8 | 50.8 | 44.6 | 63.4 |
| 1885 | 38.4 | 48.0 | 58.3 | [65.0] | 70.9 | 77.1 | 87.3 | 85.9 | 78.0 | 63.8 | 53.8 | 45.0 | [64.3] |
| 1886 | 44.4 | 52.5 | 51.8 | 60.5 | 75.0 | 82.8 | 89.7 | 86.4 | 77.0 | 62.1 | 48.7 | 46.2 | 64.8 |
| 1887 | 42.3 | 47.1 | 59.6 | 62.6 | 72.6 | 83.3 | 86.0 | 84.0 | 74.6 | 65.9 | [50.0] | 40.4 | [64.0] |
| 1888 | 43.6 | 50.8 | 51.4 | 66.2 | 71.3 | 81.4 | 87.7 | 85.6 | 81.8 | [65.0] | 51.8 | 46.2 | [65.2] |
| 1889 | 42.0 | 45.8 | 54.0 | 65.5 | 72.1 | 82.4 | 87.2 | 83.8 | 71.9 | 63.3 | 49.0 | 49.4 | 63.9 |
| 1890 | 42.4 | 48.4 | 55.4 | 62.6 | 72.4 | 78.8 | ...... | ...... | ...... | ...... | ...... | ...... | ...... |
| Means | 43.2 | 49.5 | 55.9 | 63.1 | 70.8 | 80.0 | 86.2 | 84.3 | 75.7 | 63.7 | 50.0 | 51.6 | 64.5 |

### SAN SIMON, ARIZ.

| Year. | Jan. | Feb. | Mar. | Apr. | May. | June. | July. | Aug. | Sept. | Oct. | Nov. | Dec. | Annual. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1881 | ...... | ...... | ...... | ...... | ...... | ...... | ...... | ...... | ...... | ...... | ...... | 46.9 | ...... |
| 1882 | 42.4 | 49.1 | [58.0] | 64.6 | 70.2 | 77.6 | 89.3 | 84.1 | 76.9 | 73.0 | 61.5 | 56.3 | [66.9] |
| 1883 | 44.6 | 48.7 | 57.9 | 62.9 | [75.0] | 85.0 | 80.7 | 83.1 | 76.4 | 68.7 | 60.5 | 55.0 | [66.5] |
| 1884 | 45.6 | 51.7 | 58.7 | 62.7 | 73.5 | 81.8 | 88.4 | 81.3 | 78.3 | 71.3 | 61.0 | 46.5 | 66.7 |
| 1885 | 41.3 | 46.7 | 57.8 | 66.0 | 75.1 | 81.4 | 85.3 | 81.2 | [79.0] | [70.0] | 60.0 | [50.0] | [66.2] |
| 1886 | 42.2 | 49.6 | [56.0] | 67.8 | 74.1 | 84.3 | 85.5 | 84.6 | 83.2 | 71.0 | 53.8 | 50.1 | [66.8] |
| 1887 | 44.5 | 50.2 | 57.4 | 64.0 | 75.9 | 86.2 | 85.5 | 85.4 | 81.2 | 71.2 | 50.5 | 42.0 | 66.2 |
| 1888 | 51.5 | 57.0 | 54.7 | 66.8 | 79.7 | 80.5 | [85.0] | [84.0] | 80.6 | 69.0 | 56.5 | 51.8 | [68.1] |
| 1889 | 44.5 | 47.0 | 50.5 | 63.7 | 75.0 | 79.8 | 81.8 | 81.5 | 74.7 | [70.0] | [58.0] | 57.1 | [65.3] |
| 1890 | 52.7 | 55.0 | 60.0 | 64.5 | 77.3 | 75.0 | ...... | ...... | ...... | ...... | ...... | ...... | ...... |
| Means | 45.5 | 50.6 | 56.8 | 64.8 | 75.1 | 81.3 | 85.2 | 83.2 | 78.8 | 70.5 | 57.7 | 50.6 | 66.7 |

### SIGNAL, ARIZ.

| Year. | Jan. | Feb. | Mar. | Apr. | May. | June. | July. | Aug. | Sept. | Oct. | Nov. | Dec. | Annual. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1889 | ...... | ...... | ...... | ...... | ...... | 84.0 | 93.0 | 91.8 | 80.6 | 69.4 | 55.8 | 52.8 | ...... |
| 1890 | 45.5 | 51.4 | 58.2 | 66.2 | 69.9 | 80.7 | 92.1 | 87.4 | 82.9 | ...... | ...... | ...... | ...... |

*Mean monthly and annual temperature for forty-nine stations in Arizona*—Continued.

TEXAS HILL, ARIZ.

| Year. | Jan. | Feb. | Mar. | Apr. | May. | June. | July. | Aug. | Sept. | Oct. | Nov. | Dec. | Annual. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1879 ............ | ...... | ...... | ...... | ...... | ...... | ...... | 100.5 | [92.0] | 89.0 | 73.3 | 57.6 | 51.9 | ........ |
| 1880 ............ | 51.9 | [50.0] | 61.7 | 73.9 | 84.6 | 93.6 | 98.0 | 95.5 | 88.4 | 75.3 | 57.1 | 55.4 | [73.8] |
| 1881 ............ | 51.2 | 61.5 | 65.6 | 77.9 | 86.2 | 94.5 | 100.6 | 96.8 | 89.7 | 75.8 | 58.4 | 56.3 | 76.2 |
| 1882 ............ | 51.2 | 55.3 | 64.0 | 73.0 | 83.5 | 91.1 | 102.1 | 97.8 | [85.0] | 73.5 | 60.8 | 55.7 | [74.4] |
| 1883 ............ | 49.8 | 56.4 | 70.5 | 72.4 | 81.8 | 93.6 | 99.1 | 99.8 | 92.0 | 71.7 | [60.0] | 54.8 | [75.2] |
| 1884 ............ | 52.5 | 57.5 | 62.3 | 69.4 | 80.2 | 88.9 | 96.9 | 93.6 | 84.7 | 73.8 | 61.2 | 51.6 | 72.7 |
| 1885 ............ | 49.3 | 57.1 | 68.0 | 75.5 | 86.2 | 88.7 | 96.7 | 95.9 | 88.3 | 75.4 | [62.0] | [55.0] | [74.8] |
| 1886 ............ | 53.5 | 60.8 | 61.7 | 70.2 | 87.2 | 93.2 | 97.3 | 96.5 | 87.5 | 69.9 | 57.3 | 56.5 | 74.3 |
| 1887 ............ | 51.1 | 53.6 | 69.6 | 70.1 | 82.6 | 92.9 | 99.0 | 97.5 | 87.6 | 75.8 | 61.5 | 48.7 | 74.2 |
| 1888 ............ | 49.4 | 59.2 | 62.2 | 78.9 | 86.1 | 90.3 | 100.9 | 97.9 | 91.9 | 77.0 | 63.4 | 51.7 | 75.7 |
| 1889 ............ | 44.6 | 57.2 | 68.0 | 80.6 | 82.8 | 91.4 | 99.2 | 101.1 | 86.2 | 75.4 | 56.6 | 54.7 | 74.8 |
| 1890 ............ | 46.7 | 47.8 | 64.3 | 73.1 | 83.4 | 89.0 | ...... | ...... | ...... | ...... | ...... | ...... | ........ |
| Means .... | 50.1 | 56.0 | 65.3 | 74.1 | 84.1 | 91.6 | 99.1 | 96.8 | 88.2 | 74.3 | 59.6 | 53.8 | 74.4 |

THOMAS, FORT, ARIZ.

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1880 ............ | ...... | ...... | ...... | 59.0 | 68.3 | 78.3 | 80.4 | 79.4 | 72.1 | 58.8 | 44.7 | 42.8 | ........ |
| 1881 ............ | 37.8 | 48.1 | 50.9 | 64.3 | 71.0 | 80.7 | 81.9 | 78.7 | 71.0 | 55.7 | 44.4 | 43.5 | 60.7 |
| 1882 ............ | 41.8 | 45.1 | 53.8 | 59.5 | 68.0 | 76.7 | 85.2 | 80.1 | 72.2 | 59.0 | 50.8 | 43.2 | 61.3 |
| 1883 ............ | 40.2 | 46.3 | 56.4 | 58.0 | 67.9 | 81.7 | 82.3 | 81.4 | 75.7 | 58.9 | 48.6 | 45.5 | 61.9 |
| 1884 ............ | 40.7 | 47.5 | 51.9 | 56.5 | 66.7 | 77.0 | 86.4 | 81.0 | 72.6 | 65.2 | 51.4 | 41.7 | 61.6 |
| 1885 ............ | 39.7 | 46.0 | 55.8 | 60.6 | 69.2 | 75.8 | 83.3 | 81.5 | 75.1 | 61.7 | 51.2 | 42.8 | 61.9 |
| 1886 ............ | 41.2 | 47.7 | 49.2 | 58.9 | 73.7 | 80.1 | 87.0 | 83.5 | 72.6 | 61.4 | 46.4 | 43.5 | 62.1 |
| 1887 ............ | 42.6 | 47.4 | 58.8 | 60.9 | 73.5 | 83.6 | 85.2 | 83.6 | 76.4 | 63.8 | 49.6 | 39.5 | 63.7 |
| 1888 ............ | 44.6 | 49.6 | 54.0 | 66.5 | 69.0 | 81.0 | 87.4 | 84.7 | 79.7 | 64.8 | 53.6 | 46.4 | 65.1 |
| 1889 ............ | 42.4 | 45.9 | 55.5 | 65.1 | 71.4 | 83.2 | 87.8 | 87.2 | 75.4 | 65.2 | 48.0 | 50.3 | 64.8 |
| 1890 ............ | 44.2 | 48.6 | 56.7 | 63.6 | 72.8 | 79.3 | ...... | ...... | ...... | ...... | ...... | ...... | ........ |
| Means .... | 41.5 | 47.2 | 54.3 | 61.2 | 70.1 | 79.8 | 84.7 | 82.1 | 74.3 | 61.4 | 48.9 | 43.9 | 62.4 |

TOMBSTONE, ARIZ.

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1889 ............ | ...... | ...... | ...... | ...... | 65.4 | 77.4 | 78.6 | 77.9 | ...... | ...... | 51.0 | ...... | ........ |
| 1890 ............ | 46.8 | 49.4 | ...... | ...... | 71.8 | 78.2 | 79.7 | 75.6 | 73.5 | ...... | ...... | ...... | ........ |

TUCSON, ARIZ.

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1875 ............ | ...... | ...... | ...... | ...... | ...... | ...... | ...... | ...... | ...... | ...... | 57.8 | 50.7 | ........ |
| 1876 ............ | 48.2 | 54.4 | 56.7 | 67.4 | 75.1 | 86.7 | 86.0 | 79.7 | 76.5 | 67.1 | 57.4 | 47.7 | 66.9 |
| 1877 ............ | 49.9 | 52.2 | 61.3 | 59.8 | 69.6 | 84.4 | 88.8 | 87.8 | 79.1 | 69.7 | 54.7 | 49.4 | 67.2 |
| 1878 ............ | 45.4 | 50.1 | 56.8 | 62.1 | 68.5 | 77.4 | 87.7 | 83.7 | 77.0 | 71.9 | 56.3 | 47.4 | 65.4 |
| 1879 ............ | 49.5 | 58.3 | 65.5 | 66.5 | 75.2 | 82.9 | 85 7 | 85.3 | 83.2 | 68.8 | 56.2 | 50.7 | 69.0 |
| 1880 ............ | 51.1 | 47.2 | 54.2 | 63.9 | 76.5 | 86.6 | 86.0 | 83.6 | 80.8 | 69.9 | 56.7 | 52.3 | 67.4 |
| 1881 ............ | 45.8 | 55.8 | 57.2 | 69.0 | 75.5 | 84.6 | 83.8 | 82.1 | 76.8 | 68.2 | 53.6 | 52.9 | 67.1 |
| 1882 ............ | 48.5 | 50.0 | 58.0 | 63.4 | 72.8 | 80.2 | 86.6 | 81.3 | 77.0 | 64.6 | 56.9 | 51.5 | 65.9 |
| 1883 ............ | 46.8 | 52.0 | 60.5 | 62.9 | 70.8 | 90.9 | 98.0 | 95.1 | 81.5 | 70.7 | 57.0 | 56.4 | 70.2 |
| 1884 ............ | 49.7 | 63.0 | 65.2 | 71.8 | 75.5 | 85.8 | 92.4 | 85.2 | 83.4 | 74.7 | 64.4 | 54.2 | 72.1 |
| 1885 ............ | 49.2 | [55.0] | 66.3 | 75.4 | 79.1 | 87.4 | 98.4 | 91.1 | 87.8 | 76.5 | 64.8 | 52.1 | [73.2] |
| 1886 ............ | 41.1 | 54.3 | 51.2 | 61.4 | 80.5 | 87.3 | 88.7 | 93.5 | 84.4 | 72.1 | 58.8 | 58.8 | 69.3 |
| 1887 ............ | 52.1 | 52.1 | 67.0 | 70.1 | 87.9 | 91.1 | 90.9 | 89.0 | 86.2 | 81.4 | 67.1 | 54.6 | 74.1 |
| 1888 ............ | 62.7 | †70.4 | 69.9 | 68.0 | 78.5 | 92.6 | 95.6 | 94.0 | 89.2 | 75.0 | 64.3 | 62.1 | 76.9 |
| 1889 ............ | 57.4 | 54.7 | 60.9 | 67.7 | 70.3 | †73.5 | †73.8 | 93.5 | 80.4 | 76.1 | 55.1 | 50.7 | 67.8 |
| 1890 ............ | 50.7 | 51.6 | 60.3 | 67.2 | 78.5 | 94.4 | ...... | ...... | ...... | ...... | ...... | ...... | ........ |
| Means .... | 49.9 | 54.7 | 60.7 | 66.4 | 75.6 | 85.7 | 88.4 | 87.5 | 81.7 | 71.9 | 58.7 | 52.8 | 69.5 |

VERDE, FORT, ARIZ.

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1866 ............ | ...... | ...... | ...... | ...... | ...... | ...... | ...... | ...... | ...... | ...... | 66.5 | ...... | ........ |
| 1868 ............ | ...... | 56.2 | ...... | ...... | ...... | ...... | ...... | ...... | ...... | ...... | ...... | 45.2 | ........ |
| 1869 ............ | 44.2 | 46.0 | 55.5 | 59.7 | 70.1 | 81.8 | 89.5 | 78.6 | 77.2 | 61.0 | 49.0 | 40.9 | 62.8 |
| 1870 ............ | 44.9 | 50.9 | 51.4 | 63.6 | 73.0 | 79.8 | 83.2 | 80.5 | 74.2 | 63.3 | 54.1 | 38.8 | 63.1 |

*Mean monthly and annual temperature for forty-nine stations in Arizona*—Continued.

### VERDE, FORT, ARIZ.—Continued.

| Year. | Jan. | Feb. | Mar. | Apr. | May. | June. | July. | Aug. | Sept. | Oct. | Nov. | Dec. | Annual. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1871 | 45.1 | 45.3 | 53.9 | 65.3 | 71.9 | 85.9 | 89.2 | 86.9 | 76.9 | 60.8 | 47.2 | 44.0 | 64.4 |
| 1872 | 39.8 | 48.3 | 58.7 | 63.9 | 75.2 | 80.6 | 85.1 | 80.6 | 74.8 | 64.1 | 46.2 | 43.5 | 63.4 |
| 1873 | 42.2 | 43.5 | 59.1 | 61.6 | 69.9 | 80.2 | 86.8 | 81.2 | 75.7 | 62.0 | 49.8 | 39.3 | 62.6 |
| 1874 | 40.8 | 40.3 | 51.2 | 57.5 | 70.2 | 81.1 | 82.3 | 82.5 | 75.7 | 61.0 | 46.0 | 40.7 | 60.8 |
| 1875 | 40.3 | 43.5 | 48.6 | 61.8 | 73.4 | 82.6 | [83.2] | 78.2 | 73.3 | 65.9 | 48.4 | 44.1 | [61.9] |
| 1876 | 38.8 | 45.0 | 47.4 | 62.2 | 72.8 | 81.3 | 77.0 | 76.6 | 76.9 | 65.6 | 53.7 | 43.7 | 61.8 |
| 1877 | 43.7 | 50.8 | 64.1 | 56.5 | 64.6 | 78.4 | 84.8 | 84.2 | 74.1 | 59.8 | 48.9 | 42.4 | 62.7 |
| 1878 | 41.2 | 47.6 | 54.3 | 58.5 | [69.5] | 77.9 | 84.8 | 82.1 | 71.6 | 61.2 | 48.4 | 37.6 | [61.2] |
| 1879 | 39.8 | 50.2 | 59.1 | 61.4 | 70.6 | 77.0 | 80.1 | 82.8 | 76.6 | 61.2 | 46.6 | 40.5 | 62.2 |
| 1880 | 39.9 | 38.5 | 48.6 | 57.5 | 67.7 | 76.5 | 79.3 | 78.0 | 72.0 | 58.3 | 42.7 | 41.7 | 58.4 |
| 1881 | 38.1 | 46.8 | 48.7 | 64.0 | 69.7 | 78.1 | 83.1 | 78.6 | 69.5 | 60.2 | 43.6 | 42.7 | 60.3 |
| 1882 | 35.1 | 42.3 | 51.8 | 57.5 | 67.3 | 76.1 | 83.0 | 80.5 | 71.3 | 57.5 | 47.0 | 41.4 | 59.2 |
| 1883 | 39.3 | 45.5 | 55.2 | 56.6 | 66.2 | 80.0 | 80.0 | 80.4 | 74.6 | [62.0] | 48.1 | 45.6 | [61.1] |
| 1884 | 39.8 | 46.0 | 50.8 | 55.7 | 65.6 | 73.8 | 81.3 | 79.5 | 70.7 | 64.2 | 51.0 | 37.2 | 59.6 |
| 1885 | 39.3 | 46.5 | 54.2 | 61.8 | 69.0 | 73.3 | 83.3 | 81.3 | 74.1 | 63.9 | 52.4 | 45.8 | 62.1 |
| 1886 | 42.2 | 50.0 | 48.4 | 55.8 | 70.0 | 75.0 | 84.6 | 79.7 | 72.4 | 60.8 | 45.5 | 45.4 | 60.8 |
| 1887 | 40.0 | 46.0 | 57.0 | 58.4 | 66.7 | 76.6 | 80.4 | 79.8 | 72.9 | 61.7 | 49.6 | 38.7 | 60.6 |
| 1888 | 37.6 | 48.8 | 49.7 | 63.4 | 66.4 | 75.2 | 83.4 | 80.2 | 76.6 | 63.3 | 51.0 | 44.2 | 61.6 |
| 1889 | 38.5 | 42.5 | 52.2 | 60.8 | 69.2 | 76.3 | 83.3 | 84.2 | 73.6 | 63.1 | 47.7 | 48.6 | 61.7 |
| 1890 | 41.8 | 46.2 | 52.2 | 60.5 | 69.6 | 74.4 | ...... | ...... | ...... | ...... | ...... | ...... | ...... |
| Means | 40.6 | 46.4 | 53.3 | 60.2 | 69.5 | 78.3 | 83.2 | 80.8 | 74.0 | 61.9 | 49.2 | 42.4 | 61.6 |

### WALLEN, CAMP, ARIZ.

| Year. | Jan. | Feb. | Mar. | Apr. | May. | June. | July. | Aug. | Sept. | Oct. | Nov. | Dec. | Annual. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1866 | ...... | ...... | ...... | ...... | ...... | ...... | ...... | ...... | ...... | ...... | 48.1 | 43.2 | ...... |
| 1867 | 47.4 | 42.9 | 52.5 | 61.4 | [67.5] | 76.9 | 80.7 | 76.5 | 73.5 | 62.8 | 52.9 | 52.9 | [62.3] |
| 1868 | 44.4 | 49.3 | 52.7 | 61.0 | 66.3 | 77.5 | 77.6 | 72.9 | 69.8 | 64.5 | 55.9 | 49.5 | 61.8 |
| 1869 | 42.8 | 47.4 | 57.2 | 59.5 | 68.8 | 77.9 | 77.8 | 75.4 | 71.8 | [63.6] | [52.3] | [48.5] | [61.9] |
| Means | 44.9 | 46.5 | 54.1 | 60.6 | 67.5 | 77.4 | 78.7 | 74.9 | 71.7 | 63.6 | 52.3 | 48.5 | 61.7 |

### WHIPPLE BARRACKS (PRESCOTT), ARIZ.

| Year. | Jan. | Feb. | Mar. | Apr. | May. | June. | July. | Aug. | Sept. | Oct. | Nov. | Dec. | Annual. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1865 | 40.2 | 37.8 | 42.7 | 48.2 | 70.5 | 75.7 | 74.0 | 71.0 | 66.5 | 57.3 | 42.9 | 24.7 | 54.3 |
| 1866 | 27.4 | 39.3 | 43.5 | 53.2 | ...... | ...... | ...... | ...... | 65.6 | 56.2 | 47.0 | 43.7 | ...... |
| 1867 | 41.6 | 39.2 | 41.8 | 53.0 | 65.6 | 79.2 | 79.7 | 74.2 | 66.5 | 56.5 | 47.4 | 44.2 | 57.4 |
| 1868 | 33.3 | 38.1 | 39.9 | 51.1 | 66.3 | 64.6 | 67.8 | 69.6 | 63.8 | 54.0 | 40.3 | 32.8 | 51.8 |
| 1869 | 32.0 | 38.9 | ...... | ...... | ...... | ...... | ...... | ...... | ...... | 58.2 | 45.2 | 34.0 | ...... |
| 1870 | 38.0 | 41.9 | 43.6 | 56.4 | 63.0 | 68.9 | 72.9 | 69.1 | 61.4 | 52.9 | 46.9 | 33.2 | 54.0 |
| 1871 | 40.7 | 43.5 | 50.1 | 50.5 | 62.7 | 71.8 | 77.1 | 76.4 | 68.2 | 56.2 | 43.8 | 41.8 | 56.9 |
| 1872 | 35.8 | 42.7 | 47.2 | 49.6 | 63.8 | 72.8 | 75.0 | 72.5 | 68.7 | 57.6 | 45.0 | 40.2 | 55.9 |
| 1873 | 39.1 | 36.4 | 51.2 | 53.6 | 60.3 | 72.9 | 79.1 | 73.1 | 69.0 | 55.7 | 46.7 | 35.1 | 56.0 |
| 1874 | 38.6 | 35.5 | 41.5 | 49.5 | 60.9 | 72.0 | 74.3 | 73.8 | 67.4 | 55.2 | ...... | ...... | ...... |
| 1875 | ...... | ...... | ...... | ...... | 68.5 | 76.5 | 75.7 | 75.3 | 70.3 | 62.2 | 48.4 | 40.9 | ...... |
| 1876 | 31.2 | 30.4 | 33.7 | 43.5 | 51.4 | 66.7 | 71.6 | 65.1 | 59.3 | 50.5 | 42.9 | 39.0 | 48.8 |
| 1877 | 24.4 | 38.6 | 44.7 | [50.6] | 51.9 | 65.1 | 75.8 | 73.7 | 66.1 | 53.7 | 41.7 | 34.5 | [51.7] |
| 1878 | 33.0 | 39.3 | 45.0 | 49.3 | 59.0 | 67.0 | 75.8 | 71.8 | 61.4 | 53.3 | 40.8 | 31.7 | 52.3 |
| 1879 | 31.7 | 44.0 | 50.5 | 53.0 | 59.5 | 68.2 | 73.7 | 73.2 | 70.1 | 54.5 | 42.4 | 35.8 | 54.7 |
| 1880 | 35.4 | 29.0 | 40.4 | 49.3 | 58.0 | 67.0 | 69.8 | 69.3 | 62.5 | 51.7 | 37.0 | 38.1 | 50.6 |
| 1881 | 35.1 | 41.1 | 40.6 | 54.7 | 58.7 | 67.4 | 72.0 | 68.4 | 61.4 | 52.9 | 38.4 | 39.7 | 52.5 |
| 1882 | 30.4 | 33.6 | 43.2 | 48.4 | 57.3 | 65.9 | 72.9 | 69.7 | 61.6 | 50.5 | 41.6 | 38.2 | 51.1 |
| 1883 | 34.5 | 37.6 | 47.4 | 47.9 | 56.5 | 69.0 | 70.4 | 70.1 | 64.5 | 49.9 | 42.5 | 40.1 | 52.5 |
| 1884 | 37.0 | 38.5 | 40.8 | 45.4 | 54.7 | 62.8 | 71.9 | 68.1 | 60.5 | 53.5 | 43.4 | 33.6 | 50.8 |
| 1885 | 32.8 | 40.2 | 46.0 | 51.6 | 59.0 | 63.5 | 73.2 | 70.8 | 64.9 | 54.9 | 44.3 | 38.8 | 53.3 |
| 1886 | 35.4 | 42.0 | 38.7 | 46.7 | 61.9 | 67.4 | 74.0 | 71.2 | 64.3 | 51.2 | 36.1 | 40.5 | 52.4 |
| 1887 | 37.4 | 37.5 | 49.9 | 49.7 | 59.3 | 69.5 | 72.5 | 71.1 | 65.5 | 54.4 | 44.7 | 31.7 | 53.6 |
| 1888 | 27.5 | 40.5 | 41.0 | 55.3 | 58.6 | 68.4 | 74.2 | 70.1 | 67.6 | 55.9 | 43.8 | 37.9 | 53.4 |
| 1889 | 28.4 | 34.2 | 44.0 | 53.4 | 59.2 | 66.6 | 74.6 | 73.4 | 63.6 | 54.4 | 42.8 | 42.2 | 53.1 |
| 1890 | 32.9 | 39.2 | 45.2 | 51.6 | 59.2 | 63.6 | ...... | ...... | ...... | ...... | ...... | ...... | ...... |
| Means | 34.2 | 38.4 | 43.9 | 50.6 | 60.2 | 68.9 | 73.8 | 71.3 | 65.0 | 54.5 | 43.2 | 37.2 | 53.4 |

*Mean monthly and annual temperature for forty-nine stations in Arizona*—Continued.

### WICKENBURGH, ARIZ.

| Year. | Jan. | Feb. | Mar. | Apr. | May. | June. | July. | Aug. | Sept. | Oct. | Nov. | Dec. | Annual. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1875 | ...... | ...... | ...... | ...... | ...... | ...... | ...... | ...... | ...... | ...... | 53.2 | 50.4 | ...... |
| 1876 | 46.5 | 50.6 | 58.7 | ...... | ...... | ...... | ...... | ...... | 77.6 | 67.1 | 56.0 | 45.6 | ...... |
| 1877 | 46.4 | 52.0 | 59.4 | 58.7 | 66.9 | 84.7 | 91.4 | 86.9 | 76.6 | 59.4 | 49.5 | 42.2 | 64.5 |
| 1878 | 41.6 | 45.7 | 53.2 | 58.7 | 68.0 | 75.5 | 84.2 | 84.8 | 71.8 | 61.9 | 52.0 | 42.3 | 61.6 |
| 1879 | 43.2 | 53.3 | 59.6 | 63.9 | [69.0] | 78.2 | 85.6 | 84.8 | 74.7 | 63.3 | 49.2 | 43.7 | [64.0] |
| 1880 | 44.7 | 40.6 | 47.7 | 57.1 | 69.7 | 78.9 | 76.2 | 81.9 | 75.6 | 63.2 | 48.2 | 44.4 | 60.7 |
| 1881 | 40.4 | 46.5 | 51.5 | 64.5 | 70.5 | 78.7 | 84.8 | 80.0 | 71.1 | 60.7 | 47.3 | 47.2 | 61.9 |
| 1882 | 42.5 | 44.6 | 52.5 | 58.0 | ...... | ...... | ...... | ...... | ...... | ...... | ...... | ...... | ...... |
| 1883 | ...... | ...... | ...... | 59.5 | 69.4 | 80.7 | 84.7 | 85.7 | [75.0] | 60.8 | 55.0 | 50.3 | ...... |
| 1884 | 47.1 | 50.2 | 52.6 | 57.9 | 66.8 | 72.8 | 85.8 | 83.4 | 74.6 | 66.4 | 56.5 | 46.7 | 63.4 |
| 1885 | 45.8 | 51.6 | 60.1 | 62.9 | 70.8 | 75.1 | 85.9 | 87.2 | 78.2 | 69.1 | 55.5 | 53.4 | 66.3 |
| 1886 | 49.0 | ...... | ...... | ...... | ...... | ...... | ...... | ...... | ...... | ...... | ...... | ...... | ...... |
| Means | 44.7 | 48.3 | 55.0 | 60.1 | 68.9 | 78.1 | 84.8 | 84.3 | 75.0 | 63.5 | 52.2 | 46.6 | 63.5 |

### WILLCOX, ARIZ.

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1880 | ...... | ...... | ...... | ...... | ...... | ...... | ...... | ...... | ...... | 65.6 | 57.2 | 38.7 | ...... |
| 1881 | [41.0] | 50.2 | 61.1 | 70.8 | 70.7 | [75.3] | 87.2 | 84.5 | [71.0] | 63.1 | 45.3 | 46.3 | [63.9] |
| 1882 | 43.3 | 44.7 | 54.2 | 63.5 | 72.6 | [75.3] | 87.2 | 81.8 | 71.8 | 59.4 | 50.1 | 45.0 | [62.4] |
| 1883 | 38.3 | 43.2 | 51.3 | 60.4 | 74.0 | 86.2 | 84.7 | 79.5 | 74.8 | 60.8 | 47.8 | 47.6 | 62.4 |
| 1884 | 46.0 | 43.2 | 43.4 | 47.1 | 56.5 | 71.7 | 82.5 | 77.2 | 70.3 | 61.8 | 49.5 | 45.6 | 57.9 |
| 1885 | 42.8 | 50.4 | 55.0 | 59.1 | 66.2 | 72.0 | 80.0 | 78.3 | 71.4 | 60.8 | 51.1 | 44.2 | 60.9 |
| 1886 | 41.8 | 48.4 | 48.4 | 55.8 | 70.8 | 75.6 | 83.9 | 81.4 | 70.4 | 60.4 | 48.2 | 45.8 | 60.9 |
| 1887 | 40.8 | 45.0 | 54.0 | 55.0 | 64.1 | 74.6 | 78.3 | 77.8 | 71.6 | 61.1 | 49.7 | 37.9 | 59.2 |
| 1888 | 43.1 | 47.4 | 46.0 | 61.6 | 64.5 | 73.8 | 78.5 | 76.3 | 71.5 | 61.6 | 44.8 | 44.0 | 59.4 |
| 1889 | 40.1 | 43.5 | 51.2 | 60.2 | 67.0 | 75.4 | 79.7 | 79.4 | 67.8 | 60.6 | 46.4 | 49.2 | 60.0 |
| 1890 | 43.9 | 46.7 | 53.6 | 59.5 | 66.8 | 72.9 | ...... | ...... | ...... | ...... | ...... | ...... | ...... |
| Means | 42.1 | 46.3 | 51.8 | 59.3 | 67.3 | 75.3 | 82.4 | 79.6 | 71.2 | 61.5 | 49.0 | 44.4 | 60.8 |

### WILLOW GROVE, CAMP, ARIZ.

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1868 | [36.6] | 39.2 | 42.2 | 51.0 | 57.0 | 68.8 | 74.8 | 71.9 | 67.6 | 58.0 | 44.1 | 41.5 | 54.4 |
| 1869 | 36.6 | 38.2 | 45.9 | 51.5 | 61.6 | 73.5 | 77.3 | 74.4 | 70.4 | [58.0] | [44.1] | [41.5] | 56.1 |
| Means | 36.6 | 38.7 | 44.0 | 51.2 | 59.3 | 71.2 | 76.0 | 73.2 | 69.0 | 58.0 | 44.1 | 41.5 | 55.2 |

### WILLIAMS, ARIZ.

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1888 | ...... | ...... | ...... | ...... | ...... | ...... | ...... | 65.4 | 60.9 | 48.3 | 39.3 | 32.7 | ...... |
| 1889 | 24.6 | 19.1 | 38.4 | 47.8 | 52.2 | 61.4 | 67.5 | 63.8 | 50.2 | 51.2 | 32.3 | 38.9 | 45.6 |
| Means | ...... | ...... | ...... | ...... | ...... | ...... | ...... | 64.6 | 55.6 | 49.8 | 35.8 | 35.8 | 46.0 |

### WINSLOW, ARIZ.

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1888 | ...... | ...... | ...... | ...... | ...... | ...... | ...... | 78.0 | 69.8 | 55.9 | 43.7 | 35.6 | ...... |
| 1889 | ...... | ...... | 44.4 | 53.6 | ...... | 80.8 | 78.4 | 75.6 | 70.6 | 61.8 | 41.2 | 39.9 | ...... |
| 1890 | 39.9 | ...... | ...... | ...... | ...... | ...... | ...... | ...... | ...... | ...... | ...... | ...... | ...... |
| Means | ...... | ...... | ...... | ...... | ...... | ...... | ...... | 76.8 | 70.2 | 58.8 | 42.4 | 37.8 | ...... |

### YUMA, ARIZ.

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1875 | ...... | ...... | ...... | ...... | ...... | ...... | ...... | ...... | ...... | 76.8 | 63.0 | 57.3 | ...... |
| 1876 | 50.9 | 59.5 | 61.9 | 72.7 | 81.8 | 89.3 | 93.9 | 90.3 | 86.3 | 77.0 | 65.4 | 59.3 | 74.0 |
| 1877 | 60.3 | 65.0 | 71.8 | 68.4 | *75.3 | 88.7 | 94.0 | 92.7 | 83.3 | 71.4 | 58.5 | 54.5 | 73.7 |

* Fourteen days.

*Mean monthly and annual temperature for forty-nine stations in Arizona*—Continued.

YUMA, ARIZ.—Continued.

| Year. | Jan. | Feb. | Mar. | Apr. | May. | June. | July. | Aug. | Sept. | Oct. | Nov. | Dec. | Annual. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1878 | 54.8 | 59.6 | 64.6 | 66.7 | 76.8 | 85.1 | 93.3 | 91.6 | 83.0 | 73.4 | 62.0 | 53.4 | 72.0 |
| 1879 | 53.1 | 63.7 | 70.5 | 71.8 | 77.7 | 85.5 | 92.0 | 92.5 | 87.7 | 72.8 | 59.9 | 52.8 | 73.3 |
| 1880 | 55.2 | 52.2 | 58.3 | 67.5 | 76.6 | 85.6 | 89.6 | 90.0 | 83.2 | 71.2 | 56.7 | 56.1 | 70.2 |
| 1881 | 52.3 | 62.1 | 63.5 | 72.6 | 78.1 | 84.8 | 91.9 | 88.6 | 82.7 | 70.4 | 58.3 | 57.0 | 71.9 |
| 1882 | 50.2 | 54.4 | 62.3 | 67.1 | 77.2 | 83.0 | 93.0 | 92.0 | 82.7 | 69.6 | 59.5 | 58.0 | 70.8 |
| 1883 | 51.7 | 55.6 | 67.3 | 67.1 | 74.4 | 87.3 | 92.1 | 91.0 | 85.7 | 66.7 | 61.4 | [56.0] | [71.4] |
| 1884 | 54.6 | 57.3 | 60.9 | 67.4 | 75.3 | 81.7 | 90.6 | 88.9 | 80.0 | 71.7 | 63.3 | 53.0 | 70.4 |
| 1885 | 52.6 | 59.8 | 67.2 | 70.7 | 78.2 | 81.2 | 89.1 | 90.5 | 84.7 | 74.7 | 63.3 | 57.5 | 72.5 |
| 1886 | 55.0 | 62.7 | 60.5 | 67.4 | 80.1 | 84.0 | 90.8 | 89.6 | 84.2 | 67.4 | 57.8 | 59.3 | 71.6 |
| 1887 | 55.6 | 56.1 | 69.9 | 69.8 | 77.2 | 85.9 | 92.0 | 90.9 | 84.7 | 75.8 | 63.9 | 53.1 | 72.9 |
| 1888 | 51.6 | 60.5 | 62.5 | 75.3 | 76.9 | 85.6 | 91.4 | 91.0 | 89.2 | 74.9 | 61.9 | 57.0 | 73.2 |
| 1889 | 53.4 | 58.8 | 65.6 | 73.5 | 77.6 | 85.6 | 92.0 | 92.6 | 83.8 | 72.6 | 62.0 | 58.2 | 73.0 |
| 1890 | 51.4 | 58.4 | 64.8 | 71.2 | 78.0 | 83.8 | ...... | ...... | ...... | ...... | ...... | ...... | ...... |
| Means | 53.5 | 59.0 | 64.8 | 69.9 | 77.4 | 85.1 | 91.8 | 90.9 | 84.4 | 72.4 | 61.1 | 56.2 | 72.2 |

# APPENDIX No. 10.

## *AVERAGE DAILY AND HOURLY WIND MOVEMENT AT FIVE STATIONS IN ARIZONA.*

### PHŒNIX, ARIZ.

[1879 to 1881 inclusive. Local time, which is 2 hours and 28 minutes slower than 75th meridian.]

| Month. | 1 a. m. | 2 a. m. | 3 a. m. | 4 a. m. | 5 a. m. | 6 a. m. | 7 a. m. | 8 a. m. | 9 a. m. | 10. am. | 11 a. m. | Noon. | 1 p. m. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Jan | 2.0 | 1.9 | 2.2 | 2.5 | 2.4 | 2.3 | 2.0 | 2.2 | 2.7 | 2.7 | 2.8 | 2.8 | 2.8 |
| Feb | 2.2 | 2.1 | 2.3 | 2.2 | 2.2 | 2.3 | 2.2 | 2.4 | 2.4 | 2.9 | 3.2 | 3.6 | 4.0 |
| Mar | 1.7 | 1.6 | 1.8 | 1.9 | 1.9 | 1.9 | 1.9 | 2.3 | 2.7 | 2.8 | 3.0 | 3.2 | 3.3 |
| Apr | 1.8 | 2.0 | 2.0 | 2.0 | 2.0 | 2.0 | 2.1 | 2.9 | 3.0 | 3.3 | 3.5 | 4.0 | 4.4 |
| May | 1.2 | 1.5 | 1.8 | 2.0 | 2.0 | 1.8 | 1.9 | 1.9 | 2.1 | 2.0 | 2.6 | 3.2 | 3.6 |
| June | 1.4 | 1.4 | 1.5 | 1.8 | 1.9 | 2.0 | 2.1 | 2.4 | 2.3 | 2.2 | 2.6 | 3.0 | 3.5 |
| July | 2.0 | 2.1 | 1.7 | 1.7 | 1.7 | 1.8 | 2.0 | 2.2 | 2.5 | 2.3 | 2.7 | 3.1 | 3.4 |
| Aug | 1.8 | 1.7 | 1.8 | 1.6 | 1.4 | 1.5 | 1.4 | 1.9 | 2.2 | 2.2 | 2.6 | 2.7 | 3.2 |
| Sept | 1.2 | 1.4 | 1.3 | 1.5 | 1.7 | 1.5 | 1.6 | 1.9 | 2.4 | 2.5 | 2.3 | 2.1 | 2.3 |
| Oct | 1.5 | 1.5 | 1.5 | 1.5 | 1.5 | 1.5 | 1.6 | 1.7 | 2.2 | 2.5 | 2.5 | 2.9 | 2.8 |
| Nov | 1.6 | 1.7 | 1.6 | 1.7 | 1.6 | 1.7 | 1.4 | 1.6 | 2.1 | 2.5 | 2.9 | 2.9 | 3.3 |
| Dec | 1.7 | 1.8 | 1.9 | 1.9 | 1.9 | 2.0 | 1.8 | 2.0 | 2.2 | 2.7 | 2.5 | 2.8 | 2.6 |
| **Means** | 1.68 | 1.72 | 1.78 | 1.86 | 1.85 | 1.86 | 1.83 | 2.12 | 2.40 | 2.55 | 2.77 | 3.02 | 3.27 |

| Month. | 2 p. m. | 3 p. m. | 4 p. m. | 5 p. m. | 6 p. m. | 7 p. m. | 8 p. m. | 9 p. m. | 10 p. m. | 11 p. m. | Mid-night. | Average. | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | | | Daily. | Hourly. |
| Jan. | 2.8 | 3.0 | 2.9 | 2.4 | 1.5 | 1.6 | 1.6 | 1.6 | 1.8 | 1.8 | 2.0 | 54.0 | 2.2 |
| Feb. | 4.5 | 4.6 | 4.4 | 4.2 | 3.0 | 2.5 | 2.6 | 2.0 | 2.0 | 2.0 | 2.2 | 68.0 | 2.8 |
| Mar | 3.6 | 4.0 | 4.0 | 3.6 | 2.6 | 1.8 | 1.4 | 1.3 | 1.7 | 1.4 | 1.6 | 57.1 | 2.4 |
| Apr. | 5.1 | 5.3 | 5.7 | 5.4 | 4.7 | 2.7 | 2.5 | 2.3 | 2.0 | 2.1 | 2.1 | 75.3 | 3.1 |
| May | 4.4 | 5.0 | 5.3 | 5.1 | 4.4 | 2.4 | 1.9 | 1.8 | 1.4 | 1.4 | 1.3 | 62.2 | 2.6 |
| June | 4.3 | 4.9 | 5.3 | 5.3 | 5.0 | 3.0 | 2.1 | 2.0 | 1.6 | 1.6 | 1.3 | 64.3 | 2.7 |
| July | 3.9 | 4.1 | 4.3 | 4.4 | 4.2 | 3.1 | 2.6 | 3.0 | 2.9 | 2.3 | 2.1 | 66.3 | 2.8 |
| Aug | 3.3 | 3.6 | 3.4 | 3.3 | 3.2 | 2.2 | 2.0 | 2.2 | 1.9 | 2.0 | 2.0 | 55.0 | 2.3 |
| Sept | 2.8 | 2.8 | 2.7 | 2.3 | 1.4 | 1.1 | 1.2 | 1.0 | 1.0 | 1.0 | 1.0 | 41.9 | 1.7 |
| Oct. | 3.0 | 3.1 | 2.9 | 2.2 | 1.3 | 1.0 | 1.0 | 1.0 | 1.1 | 1.4 | 1.7 | 44.9 | 1.9 |
| Nov | 3.1 | 3.1 | 2.8 | 1.7 | 1.3 | 1.0 | 0.9 | 1.1 | 1.5 | 1.6 | 1.8 | 46.6 | 1.9 |
| Dec. | 2.8 | 2.7 | 2.3 | 1.4 | 1.1 | 1.1 | 1.0 | 1.1 | 1.4 | 1.6 | 1.6 | 45.6 | 1.9 |
| **Means** | 3.63 | 3.85 | 3.83 | 3.44 | 2.81 | 1.96 | 1.73 | 1.70 | 1.69 | 1.68 | 1.72 | 56.77 | 2.37 |

### FORT GRANT, ARIZ.

[1883 to 1889 inclusive. Seventy-fifth meridian time.]

| Month. | 1 a. m. | 2 a. m. | 3 a. m. | 4 a. m. | 5 a. m. | 6 a. m. | 7 a. m. | 8 a. m. | 9 a. m. | 10 a. m. | 11 a. m. | Noon. | 1 p. m. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Jan. | 6.7 | 6.4 | 6.3 | 5.9 | 5.9 | 5.7 | 5.6 | 5.3 | 5.3 | 5.0 | 4.5 | 5.2 | 6.8 |
| Feb. | 7.3 | 6.9 | 6.6 | 6.4 | 6.4 | 5.9 | 5.7 | 5.8 | 5.5 | 5.4 | 5.5 | 6.6 | 7.7 |
| Mar. | 6.5 | 6.0 | 5.8 | 5.7 | 5.5 | 5.6 | 5.4 | 5.1 | 4.7 | 4.4 | 5.1 | 6.3 | 7.9 |
| Apr. | 6.5 | 6.1 | 5.8 | 5.7 | 5.4 | 5.2 | 5.1 | 4.8 | 4.3 | 4.7 | 6.0 | 7.3 | 8.2 |
| May | 6.1 | 6.1 | 6.0 | 5.8 | 5.8 | 5.9 | 5.7 | 5.4 | 4.9 | 4.9 | 5.9 | 7.2 | 8.3 |
| June | 6.2 | 6.2 | 5.9 | 5.7 | 5.8 | 5.4 | 5.2 | 4.7 | 3.8 | 4.3 | 5.1 | 6.0 | 7.1 |
| July | 5.7 | 5.2 | 4.9 | 4.7 | 4.3 | 4.0 | 3.7 | 3.4 | 2.9 | 3.2 | 3.8 | 4.8 | 5.9 |
| Aug. | 5.3 | 4.9 | 4.8 | 4.6 | 4.4 | 4.4 | 4.0 | 4.3 | 3.6 | 3.7 | 4.4 | 5.1 | 6.2 |
| Sept | 6.9 | 6.4 | 6.4 | 6.1 | 5.8 | 5.7 | 5.7 | 5.4 | 5.1 | 5.0 | 6.0 | 7.1 | 8.2 |
| Oct | 6.7 | 6.6 | 6.4 | 6.0 | 5.8 | 5.4 | 5.2 | 5.1 | 4.7 | 4.4 | 5.6 | 6.9 | 8.2 |
| Nov. | 6.8 | 6.4 | 5.8 | 5.7 | 5.4 | 5.1 | 5.0 | 5.1 | 4.9 | 4.4 | 5.0 | 6.2 | 7.4 |
| Dec. | 6.2 | 5.7 | 5.7 | 5.4 | 5.5 | 5.9 | 5.7 | 5.4 | 5.4 | 5.3 | 5.4 | 6.1 | 7.0 |
| **Means** | 6.41 | 6.08 | 5.87 | 5.64 | 5.50 | 5.35 | 5.17 | 4.98 | 4.59 | 4.56 | 5.19 | 6.23 | 7.37 |

*Average daily and hourly wind movement at five stations in Arizona*—Continued.

### FORT GRANT, ARIZ.—Continued.

| Month. | 2 p. m. | 3 p. m. | 4 p. m. | 5 p. m. | 6 p. m. | 7 p. m. | 8 p. m. | 9 p. m. | 10 p. m. | 11 p. m. | Mid-night. | Average. | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | | | Daily. | Hourly. |
| Jan. | 6.7 | 7.5 | 8.2 | 8.7 | 8.9 | 8.5 | 7.2 | 6.8 | 6.9 | 7.0 | 6.9 | 157.5 | 6.6 |
| Feb. | 8.8 | 9.6 | 10.2 | 10.7 | 10.9 | 9.9 | 8.7 | 7.3 | 7.3 | 7.0 | 7.0 | 179.0 | 7.5 |
| Mar | 8.7 | 9.4 | 9.8 | 10.2 | 10.4 | 10.1 | 9.0 | 7.2 | 6.8 | 6.6 | 6.5 | 168.5 | 7.0 |
| Apr. | 9.2 | 10.4 | 11.2 | 11.8 | 12.5 | 12.3 | 11.5 | 9.2 | 7.3 | 6.6 | 6.6 | 183.7 | 7.7 |
| May | 8.9 | 9.6 | 9.7 | 10.3 | 10.4 | 10.6 | 10.6 | 9.3 | 6.7 | 6.3 | 6.2 | 176.7 | 7.4 |
| June | 8.0 | 8.5 | 9.3 | 9.6 | 10.5 | 10.6 | 10.7 | 10.0 | 7.6 | 6.6 | 6.4 | 169.1 | 7.0 |
| July | 6.7 | 7.5 | 8.2 | 8.3 | 9.0 | 9.2 | 9.2 | 8.8 | 7.3 | 6.6 | 6.4 | 143.7 | 6.0 |
| Aug | 7.0 | 7.7 | 8.0 | 7.8 | 8.2 | 8.1 | 7.6 | 6.8 | 6.4 | 5.8 | 5.4 | 138.5 | 5.8 |
| Sept | 9.0 | 9.2 | 9.5 | 9.7 | 9.5 | 8.9 | 8.3 | 6.9 | 6.9 | 7.1 | 7.2 | 172.2 | 7.2 |
| Oct. | 8.5 | 8.9 | 9.1 | 9.2 | 9.1 | 8.8 | 7.2 | 6.8 | 6.9 | 7.0 | 6.9 | 165.3 | 6.9 |
| Nov | 8.0 | 8.4 | 8.3 | 8.6 | 8.5 | 7.9 | 6.9 | 7.1 | 7.2 | 7.3 | 7.0 | 158.2 | 6.6 |
| Dec. | 7.7 | 8.2 | 8.4 | 8.6 | 8.4 | 7.6 | 6.6 | 6.7 | 6.8 | 6.8 | 6.5 | 157.1 | 6.5 |
| Means. | 8.10 | 8.74 | 9.16 | 9.46 | 9.69 | 9.38 | 8.62 | 7.74 | 7.01 | 6.72 | 6.58 | 164.12 | 6.84 |

### WHIPPLE BARRACKS, ARIZ.

[1883 to 1889 inclusive. Seventy-fifth meridian time.]

| Month. | 1 a. m. | 2 a. m. | 3 a. m. | 4 a. m. | 5 a. m. | 6 a. m. | 7 a. m. | 8 a. m. | 9 a. m. | 10 a. m. | 11 a. m. | Noon. | 1 p. m. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Jan. | 3.9 | 4.0 | 3.8 | 3.6 | 3.7 | 3.5 | 3.6 | 3.8 | 3.9 | 3.9 | 4.0 | 4.5 | 6.6 |
| Feb. | 5.2 | 5.2 | 5.0 | 5.0 | 4.9 | 4.9 | 4.6 | 4.4 | 4.1 | 4.0 | 4.3 | 5.9 | 8.4 |
| Mar. | 4.9 | 4.3 | 4.1 | 3.9 | 3.7 | 3.8 | 3.8 | 3.4 | 3.4 | 3.4 | 4.2 | 6.7 | 9.4 |
| Apr. | 5.5 | 5.4 | 5.1 | 5.1 | 4.8 | 4.2 | 4.0 | 3.8 | 3.6 | 4.5 | 7.7 | 10.7 | 12.4 |
| May | 4.8 | 4.6 | 4.3 | 4.0 | 3.7 | 3.4 | 3.3 | 3.0 | 2.8 | 4.2 | 7.8 | 10.9 | 12.3 |
| June | 4.2 | 3.9 | 3.4 | 3.4 | 3.0 | 2.6 | 2.4 | 2.4 | 2.3 | 3.6 | 7.9 | 10.4 | 13.1 |
| July | 4.6 | 4.3 | 3.7 | 3.6 | 3.4 | 2.8 | 2.5 | 2.2 | 1.9 | 2.6 | 4.8 | 7.3 | 9.1 |
| Aug. | 3.9 | 3.8 | 3.3 | 3.4 | 3.2 | 3.0 | 2.8 | 2.6 | 2.2 | 2.2 | 3.7 | 6.4 | 8.0 |
| Sept | 3.6 | 3.2 | 3.1 | 2.7 | 2.8 | 2.7 | 2.6 | 2.5 | 2.5 | 2.3 | 4.1 | 7.8 | 9.5 |
| Oct. | 3.8 | 3.4 | 3.3 | 3.3 | 3.1 | 3.0 | 2.9 | 2.8 | 2.7 | 2.5 | 3.8 | 6.8 | 9.7 |
| Nov. | 3.4 | 3.3 | 3.3 | 3.3 | 3.4 | 3.2 | 3.1 | 3.1 | 3.3 | 3.3 | 3.3 | 4.6 | 7.0 |
| Dec. | 4.9 | 4.8 | 4.8 | 4.5 | 4.5 | 4.5 | 4.4 | 4.4 | 4.4 | 4.5 | 4.4 | 5.2 | 7.1 |
| Means. | 4.39 | 4.18 | 3.93 | 3.82 | 3.68 | 3.47 | 3.33 | 3.20 | 3.09 | 3.42 | 5.00 | 7.27 | 9.38 |

| Month. | 2 p. m. | 3 p. m. | 4 p. m. | 5 p. m. | 6 p. m. | 7 p. m. | 8 p. m. | 9 p. m. | 10 p. m. | 11 p. m. | Mid-night. | Average. | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | | | Daily. | Hourly. |
| Jan. | 8.5 | 9.6 | 9.5 | 9.9 | 9.3 | 8.3 | 6.6 | 5.3 | 4.7 | 4.3 | 4.1 | 132.9 | 5.5 |
| Feb. | 10.2 | 11.1 | 11.5 | 12.2 | 12.4 | 11.9 | 10.4 | 8.1 | 6.8 | 6.4 | 5.8 | 172.7 | 7.2 |
| Mar | 10.5 | 11.4 | 12.2 | 12.6 | 12.7 | 12.7 | 11.6 | 9.1 | 7.0 | 6.1 | 5.6 | 170.8 | 7.1 |
| Apr. | 13.5 | 14.3 | 14.7 | 15.4 | 15.7 | 15.3 | 14.4 | 12.4 | 8.7 | 7.3 | 6.1 | 214.8 | 9.0 |
| May | 13.5 | 14.5 | 15.0 | 15.5 | 15.8 | 15.4 | 14.7 | 12.9 | 8.6 | 6.1 | 5.2 | 206.0 | 8.6 |
| June | 14.5 | 15.3 | 16.1 | 16.7 | 17.0 | 16.5 | 15.7 | 14.0 | 9.6 | 6.4 | 4.7 | 210.0 | 8.8 |
| July | 10.1 | 11.0 | 12.0 | 12.9 | 12.7 | 12.6 | 12.0 | 10.6 | 7.9 | 5.8 | 5.0 | 165.3 | 6.9 |
| Aug | 9.1 | 9.9 | 10.9 | 11.3 | 11.7 | 11.4 | 11.3 | 9.0 | 6.5 | 5.2 | 4.3 | 148.7 | 6.2 |
| Sept | 10.3 | 10.9 | 11.6 | 11.6 | 11.5 | 11.2 | 10.3 | 7.7 | 5.4 | 4.3 | 4.0 | 148.1 | 6.2 |
| Oct. | 10.9 | 11.6 | 11.9 | 11.7 | 11.8 | 11.2 | 9.1 | 6.7 | 5.3 | 4.7 | 4.0 | 150.1 | 6.3 |
| Nov | 8.9 | 9.5 | 9.9 | 10.1 | 9.9 | 8.9 | 6.6 | 4.9 | 4.3 | 3.9 | 3.7 | 128.1 | 5.3 |
| Dec. | 8.7 | 9.6 | 9.9 | 10.1 | 9.5 | 8.1 | 6.6 | 5.8 | 5.0 | 4.7 | 4.7 | 144.9 | 6.0 |
| Means. | 10.72 | 11.56 | 12.10 | 12.50 | 12.50 | 11.96 | 10.78 | 8.88 | 6.65 | 5.43 | 4.77 | 166.03 | 6.92 |

*Average daily and hourly wind movement at five stations in Arizona*—Continued.

## FORT APACHE, ARIZ.

[1883 to 1887 inclusive. Seventy-fifth meridian time.]

| Month. | 1 a. m. | 2 a. m. | 3 a. m. | 4 a. m. | 5 a. m. | 6 a. m. | 7 a. m. | 8 a. m. | 9 a. m. | 10 a. m. | 11 a. m. | Noon. | 1 p. m. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Jan* | 4.6 | 4.5 | 4.2 | 4.1 | 3.8 | 3.7 | 3.5 | 3.2 | 3.2 | 3.1 | 3.1 | 3.4 | 4.5 |
| Feb* | 4.6 | 4.4 | 4.3 | 4.0 | 4.0 | 3.7 | 3.8 | 3.7 | 3.9 | 3.9 | 3.9 | 4.7 | 6.5 |
| Mar* | 5.0 | 4.5 | 4.4 | 4.7 | 4.4 | 4.5 | 4.2 | 4.0 | 3.9 | 3.6 | 3.8 | 5.8 | 8.6 |
| Apr | 5.6 | 4.9 | 4.9 | 4.5 | 4.6 | 4.5 | 4.3 | 4.1 | 4.0 | 4.5 | 5.1 | 8.3 | 11.3 |
| May | 5.1 | 4.5 | 4.0 | 3.9 | 4.0 | 4.1 | 3.9 | 3.7 | 3.7 | 3.6 | 4.7 | 8.5 | 11.2 |
| June | 5.1 | 4.6 | 4.2 | 3.9 | 3.9 | 3.7 | 3.6 | 3.3 | 3.3 | 3.0 | 3.8 | 7.5 | 9.7 |
| July | 4.5 | 4.2 | 4.2 | 4.0 | 3.6 | 3.5 | 3.3 | 3.3 | 3.2 | 2.8 | 2.7 | 4.7 | 6.5 |
| Aug | 4.3 | 4.3 | 3.9 | 4.0 | 3.8 | 3.6 | 3.5 | 3.3 | 3.0 | 2.9 | 2.6 | 4.0 | 6.1 |
| Sept | 4.4 | 4.2 | 4.0 | 4.0 | 3.8 | 3.6 | 3.5 | 3.6 | 3.4 | 3.5 | 3.5 | 5.0 | 7.9 |
| Oct | 4.9 | 4.5 | 4.6 | 4.2 | 4.2 | 3.9 | 3.7 | 3.7 | 3.7 | 3.5 | 3.7 | 5.2 | 8.3 |
| Nov | 4.2 | 4.3 | 3.8 | 3.8 | 3.5 | 3.0 | 3.0 | 3.1 | 2.8 | 2.7 | 2.4 | 3.0 | 5.7 |
| Dec | 4.0 | 3.8 | 3.8 | 3.6 | 3.6 | 3.4 | 3.7 | 3.7 | 3.5 | 3.7 | 3.5 | 3.4 | 5.0 |
| Means. | 4.69 | 4.39 | 4.19 | 4.06 | 3.93 | 3.77 | 3.67 | 3.56 | 3.47 | 3.40 | 3.57 | 5.29 | 7.61 |

| Month. | 2 p. m. | 3 p. m. | 4 p. m. | 5 p. m. | 6 p. m. | 7 p. m. | 8 p. m. | 9 p. m. | 10 p. m. | 11 p. m. | Mid-night. | Average. | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | | | Daily. | Hourly. |
| Jan* | 6.4 | 7.9 | 9.1 | 9.5 | 9.5 | 8.7 | 6.3 | 4.9 | 4.9 | 5.0 | 4.7 | 125.7 | 5.2 |
| Feb* | 9.0 | 10.2 | 10.9 | 11.4 | 11.3 | 10.9 | 9.1 | 6.0 | 5.1 | 5.1 | 4.8 | 149.7 | 6.2 |
| Mar* | 10.1 | 11.4 | 11.7 | 12.5 | 12.5 | 11.9 | 10.7 | 7.8 | 5.4 | 5.2 | 5.2 | 166.1 | 6.9 |
| Apr | 12.9 | 14.3 | 15.3 | 15.9 | 16.0 | 15.9 | 14.6 | 11.4 | 6.2 | 4.9 | 5.5 | 203.5 | 8.5 |
| May | 12.3 | 13.4 | 13.9 | 14.7 | 15.0 | 14.7 | 13.8 | 11.9 | 6.5 | 4.4 | 5.5 | 191.2 | 8.0 |
| June | 11.3 | 12.5 | 13.5 | 14.4 | 14.6 | 14.2 | 13.4 | 11.8 | 7.9 | 4.5 | 4.9 | 182.3 | 7.6 |
| July | 8.0 | 9.1 | 10.2 | 10.6 | 10.5 | 10.4 | 9.8 | 8.9 | 6.5 | 4.5 | 4.7 | 143.8 | 6.0 |
| Aug | 7.3 | 8.7 | 9.9 | 10.2 | 9.6 | 9.2 | 8.3 | 6.9 | 5.5 | 4.9 | 4.7 | 134.4 | 5.6 |
| Sept | 9.6 | 10.9 | 11.0 | 11.2 | 10.5 | 10.3 | 8.9 | 6.0 | 4.7 | 5.1 | 4.9 | 147.2 | 6.1 |
| Oct | 9.7 | 10.6 | 10.8 | 11.3 | 10.9 | 10.4 | 8.3 | 4.9 | 5.2 | 5.6 | 5.3 | 150.8 | 6.3 |
| Nov | 7.9 | 9.2 | 10.0 | 10.2 | 10.1 | 8.6 | 5.5 | 4.7 | 4.9 | 4.8 | 4.4 | 125.6 | 5.2 |
| Dec | 6.6 | 8.0 | 8.9 | 9.3 | 9.1 | 7.3 | 5.2 | 5.1 | 5.1 | 4.9 | 4.6 | 122.6 | 5.1 |
| Means. | 9.26 | 10.52 | 11.27 | 11.77 | 11.63 | 11.04 | 9.49 | 7.52 | 5.66 | 4.91 | 4.93 | 153.58 | 6.40 |

## YUMA, ARIZ.

[1883 to 1889 inclusive. Seventy-fifth meridian time.]

| Month. | 1 a. m. | 2 a. m. | 3 a. m. | 4 a. m. | 5 a. m. | 6 a. m. | 7 a. m. | 8 a. m. | 9 a. m. | 10 a. m. | 11 a. m. | Noon. | 1 p. m. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Jan | 4.1 | 4.3 | 4.4 | 4.6 | 4.8 | 5.2 | 5.4 | 5.3 | 5.4 | 5.3 | 5.7 | 7.1 | 9.0 |
| Feb | 5.3 | 4.8 | 4.8 | 4.6 | 4.8 | 5.0 | 5.2 | 5.0 | 5.2 | 5.2 | 5.7 | 7.5 | 9.4 |
| Mar | 5.1 | 4.5 | 4.3 | 4.1 | 3.7 | 3.8 | 3.9 | 3.9 | 4.1 | 4.3 | 5.2 | 7.0 | 8.5 |
| Apr | 7.3 | 6.4 | 5.8 | 5.3 | 4.8 | 4.7 | 4.3 | 4.3 | 4.0 | 4.2 | 5.8 | 7.6 | 8.3 |
| May | 7.0 | 6.2 | 5.4 | 4.8 | 4.4 | 3.9 | 3.4 | 3.2 | 3.2 | 3.9 | 5.8 | 6.7 | 7.5 |
| June | 5.8 | 5.3 | 4.8 | 4.3 | 4.0 | 3.4 | 3.2 | 3.1 | 2.8 | 3.9 | 5.2 | 6.2 | 6.8 |
| July | 5.8 | 5.1 | 4.7 | 4.6 | 4.5 | 4.6 | 4.4 | 3.7 | 3.8 | 5.5 | 7.5 | 8.2 | 8.5 |
| Aug | 5.4 | 4.7 | 4.4 | 4.1 | 3.9 | 3.7 | 3.6 | 3.4 | 3.2 | 4.1 | 6.0 | 6.9 | 7.3 |
| Sept | 4.1 | 4.2 | 3.4 | 3.3 | 3.1 | 2.9 | 2.9 | 2.9 | 2.9 | 3.2 | 4.4 | 5.9 | 6.6 |
| Oct | 3.5 | 3.3 | 3.2 | 3.2 | 3.1 | 3.3 | 3.3 | 3.4 | 3.4 | 3.7 | 4.2 | 5.6 | 6.7 |
| Nov | 3.6 | 3.5 | 3.6 | 3.5 | 3.7 | 3.9 | 4.2 | 4.4 | 4.9 | 5.1 | 5.4 | 6.6 | 8.2 |
| Dec | 4.1 | 3.9 | 4.0 | 4.2 | 4.3 | 4.7 | 5.0 | 5.0 | 4.9 | 5.2 | 5.3 | 6.2 | 7.8 |
| Means. | 5.09 | 4.68 | 4.40 | 4.22 | 4.09 | 4.09 | 4.07 | 3.97 | 3.98 | 4.47 | 5.52 | 6.79 | 7.88 |

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* 1883 to 1888 inclusive.

*Average daily and hourly wind movement at five stations in Arizona*—Continued.

YUMA, ARIZ.—Continued.

| Month. | 2 p. m. | 3 p. m. | 4 p. m. | 5 p. m. | 6 p. m. | 7 p. m. | 8 p. m. | 9 p. m. | 10 p. m. | 11 p. m. | Mid-night. | Average. | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | | | Daily. | Hourly. |
| Jan | 10.1 | 10.2 | 10.0 | 9.8 | 9.2 | 8.4 | 6.4 | 4.9 | 4.3 | 4.2 | 4.0 | 152.2 | 6.3 |
| Feb | 9.9 | 9.9 | 9.8 | 9.9 | 9.8 | 9.7 | 8.7 | 6.5 | 6.0 | 5.7 | 5.7 | 164.1 | 6.8 |
| Mar | 8.3 | 8.4 | 8.1 | 8.4 | 8.6 | 8.9 | 8.7 | 7.6 | 6.9 | 6.7 | 6.2 | 149.1 | 6.2 |
| Apr | 8.1 | 8.5 | 8.7 | 9.0 | 9.4 | 9.5 | 9.5 | 9.2 | 8.8 | 8.7 | 8.3 | 170.8 | 7.1 |
| May | 7.3 | 7.7 | 7.8 | 8.2 | 8.7 | 8.9 | 9.1 | 9.8 | 9.2 | 8.9 | 8.4 | 159.3 | 6.6 |
| June | 7.1 | 7.4 | 7.6 | 7.9 | 8.3 | 8.8 | 9.0 | 9.6 | 9.2 | 8.1 | 7.0 | 148.7 | 6.2 |
| July | 8.6 | 8.5 | 8.5 | 8.8 | 9.0 | 9.5 | 9.7 | 10.0 | 9.8 | 8.2 | 6.6 | 168.0 | 7.0 |
| Aug | 7.2 | 7.4 | 7.1 | 7.6 | 7.8 | 8.2 | 8.7 | 8.8 | 8.5 | 7.7 | 6.2 | 146.3 | 6.1 |
| Sept | 6.4 | 6.4 | 6.2 | 6.3 | 6.2 | 6.1 | 6.1 | 5.9 | 5.9 | 5.8 | 5.1 | 115.6 | 4.8 |
| Oct | 6.8 | 6.4 | 6.2 | 6.2 | 6.3 | 5.9 | 5.4 | 4.9 | 4.4 | 4.2 | 4.1 | 110.8 | 4.6 |
| Nov | 8.6 | 8.3 | 8.0 | 7.7 | 7.4 | 6.7 | 5.4 | 4.3 | 4.0 | 3.7 | 3.7 | 128.8 | 5.4 |
| Dec | 8.6 | 8.9 | 8.9 | 8.8 | 8.3 | 7.2 | 5.2 | 4.6 | 4.5 | 4.2 | 4.0 | 138.0 | 5.8 |
| Means. | 8.08 | 8.17 | 8.07 | 8.22 | 8.25 | 8.15 | 7.66 | 7.18 | 6.79 | 6.34 | 5.78 | 145.98 | 6.08 |

# APPENDIX No. 11.

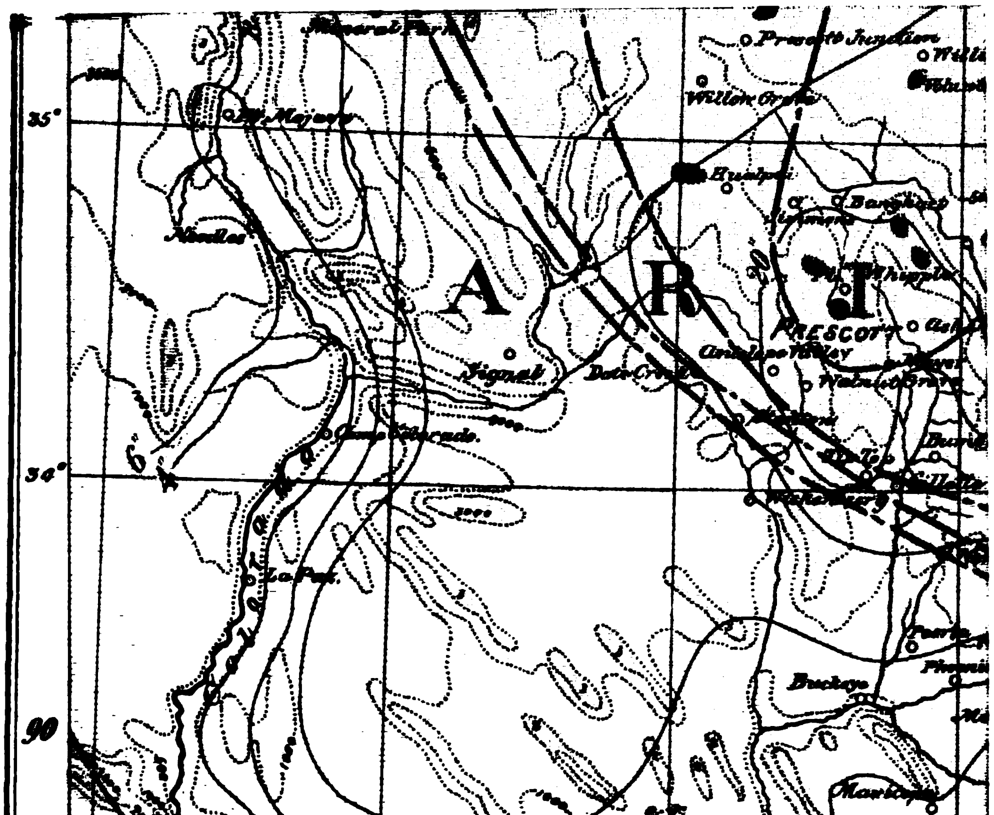
## *MEAN MAXIMUM TEMPERATURE READINGS OF SELF-REGISTERING INSTRUMENTS AT NINE STATIONS IN ARIZONA.*

| Stations. | Date. | Jan. | Feb. | Mar. | Apr. | May. | June. | July. | Aug. | Sept. | Oct. | Nov. | Dec. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | ° | ° | ° | ° | ° | ° | ° | ° | ° | ° | ° | ° |
| Fort Apache | Jan., 1880, to Sept., 1890. | 50.4 | 55.2 | 61.4 | 70.4 | 80.5 | 89.8 | 91.0 | 86.3 | 82.2 | 72.9 | 61.0 | 54.7 |
| Yuma | Jan., 1880, to June, 1890. | 64.7 | 70.5 | 77.8 | 85.3 | 93.5 | 101.2 | 106.3 | 104.7 | 99.2 | 86.3 | 73.9 | 68.0 |
| Prescott | do | 46.9 | 51.6 | 57.8 | 65.3 | 75.2 | 84.2 | 88.1 | 84.9 | 80.3 | 69.0 | 57.4 | 51.2 |
| Fort Grant | do | 53.6 | 56.6 | 62.9 | 70.4 | 79.2 | 87.8 | 91.1 | 87.6 | 82.4 | 73.9 | 62.4 | 56.8 |
| Phœnix | Jan., 1882, to Feb., 1890. | 65.7 | 71.7 | 81.6 | 86.8 | 94.6 | 104.6 | 107.3 | 104.0 | 99.2 | 90.1 | 78.7 | 73.4 |
| Florence | Oct., 1877, to Apr., 1882. | 61.8 | 66.6 | 75.0 | 82.0 | 93.1 | 102.8 | 105.2 | 102.6 | 96.8 | 84.0 | 70.9 | 64.3 |
| Fort Thomas | Apr., 1880, to Oct., 1890. | 55.9 | 62.1 | 69.9 | 78.4 | 89.0 | 96.3 | 100.8 | 96.2 | 89.8 | 78.9 | 65.0 | 58.3 |
| Tucson | Feb., 1878, to June, 1883. | 66.6 | 67.3 | 75.2 | 81.9 | 92.2 | 100.8 | 99.0 | 94.1 | 91.5 | 82.0 | 69.6 | 65.4 |
| Maricopa | Nov., 1883, to July, 1887. | 65.4 | 70.4 | 77.0 | 82.7 | 95.9 | 103.9 | 107.6 | 105.0 | 98.7 | 87.6 | 74.7 | 67.9 |

# APPENDIX No. 12.

*MEAN MINIMUM TEMPERATURE READINGS OF SELF-REGISTERING INSTRUMENTS AT NINE STATIONS IN ARIZONA.*

| Stations. | Date. | Jan. | Feb. | Mar. | Apr. | May. | June. | July. | Aug. | Sept. | Oct. | Nov. | Dec. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | ° | ° | ° | ° | ° | ° | ° | ° | ° | ° | ° | ° |
| Fort Apache | Jan., 1880, to Sept., 1890. | 20.8 | 24.7 | 29.3 | 34.4 | 40.3 | 47.9 | 58.7 | 62.6 | 49.1 | 38.5 | 26.2 | 23.8 |
| Yuma | Jan., 1880, to June, 1890. | 42.0 | 43.8 | 50.3 | 55.2 | 61.6 | 68.7 | 77.4 | 77.8 | 70.3 | 58.5 | 48.6 | 46.0 |
| Prescott | ....do | 20.7 | 24.3 | 29.9 | 36.2 | 42.5 | 48.7 | 59.0 | 58.0 | 48.8 | 38.2 | 27.1 | 26.4 |
| Fort Grant | ....do | 33.1 | 36.2 | 41.0 | 46.7 | 55.0 | 63.8 | 67.3 | 59.6 | 60.3 | 51.7 | 40.4 | 36.6 |
| Phœnix | Jan., 1882, to Feb., 1890. | 32.2 | 35.8 | 41.0 | 46.3 | 53.1 | 59.5 | 71.6 | 71.0 | 60.6 | 50.2 | 42.4 | 36.6 |
| Florence | Oct., 1877, to Apr., 1882. | 34.4 | 38.2 | 43.1 | 48.4 | 54.8 | 63.0 | 74.0 | 73.6 | 63.7 | 51.8 | 39.7 | 37.2 |
| Fort Thomas | Apr., 1880, to Oct., 1890. | 27.6 | 32.9 | 39.0 | 44.0 | 50.9 | 60.7 | 71.4 | 69.5 | 60.0 | 45.0 | 33.5 | 30.5 |
| Tucson | Feb., 1878, to June, 1883. | 35.1 | 41.6 | 44.1 | 46.7 | 55.7 | 64.2 | 74.8 | 73.9 | 67.5 | 51.6 | 42.6 | 37.0 |
| Maricopa | Nov., 1883, to July, 1887. | 36.0 | 38.9 | 44.8 | 51.7 | 62.0 | 67.9 | 79.0 | 77.6 | 67.0 | 55.5 | 42.0 | 38.1 |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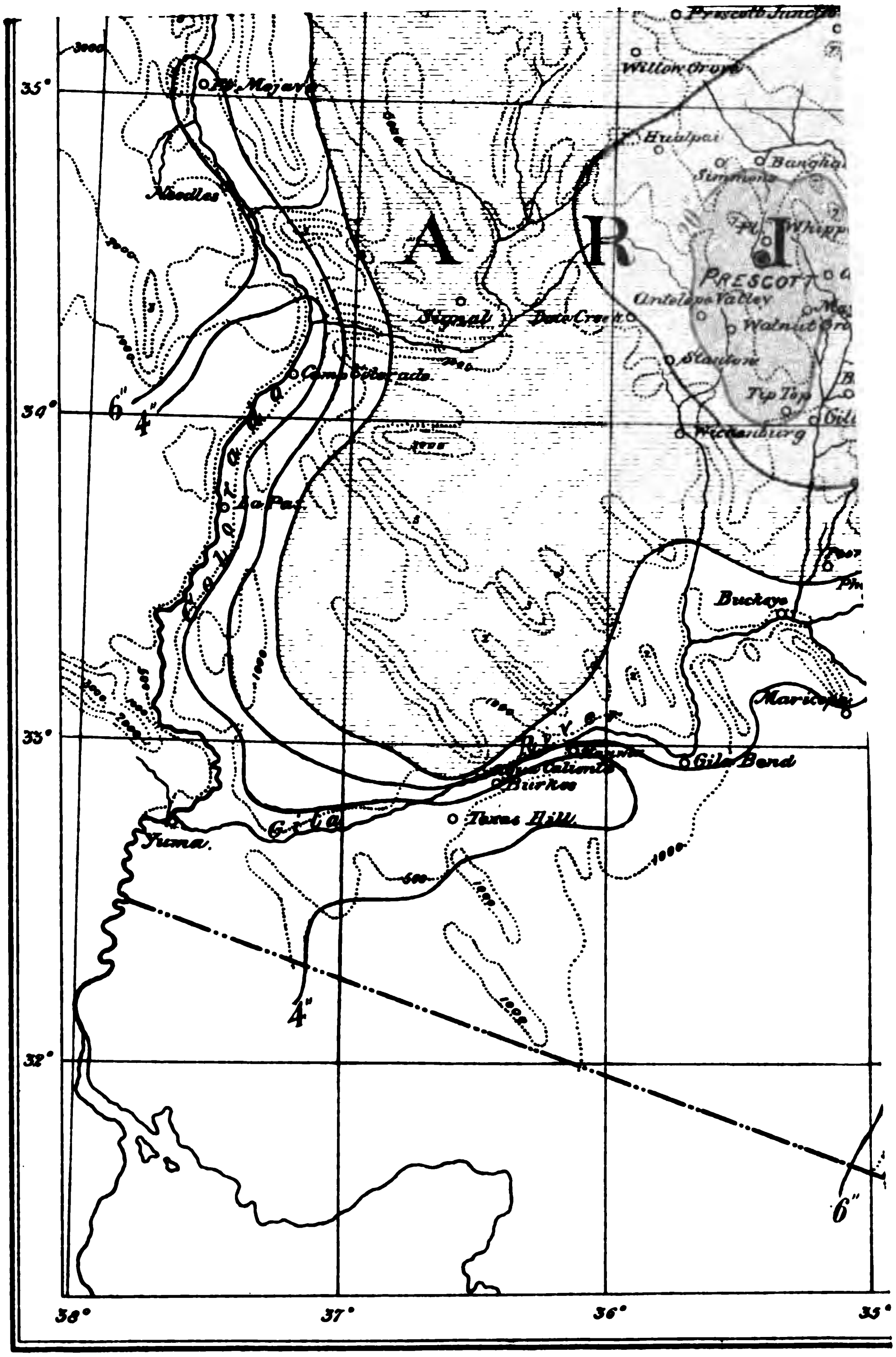

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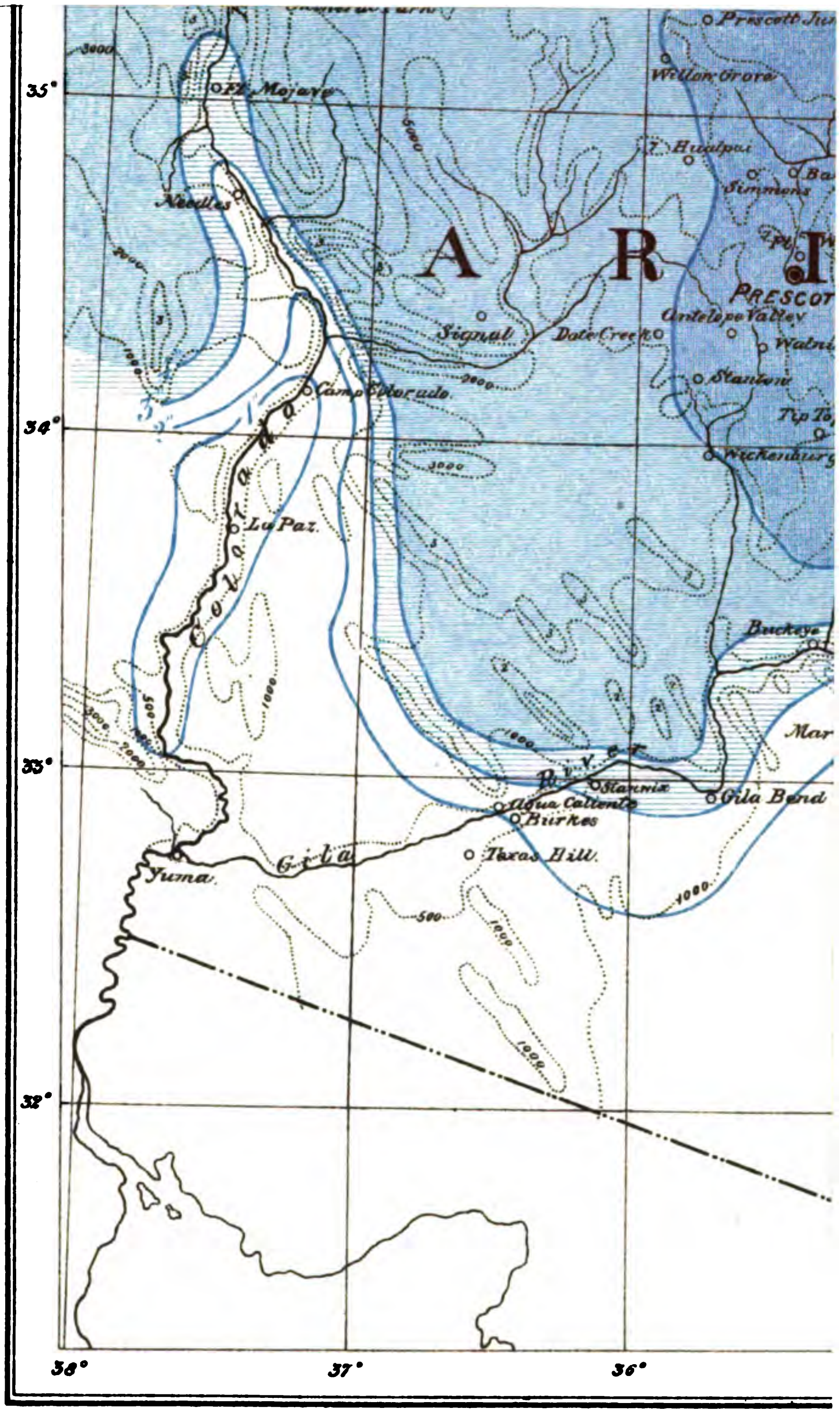

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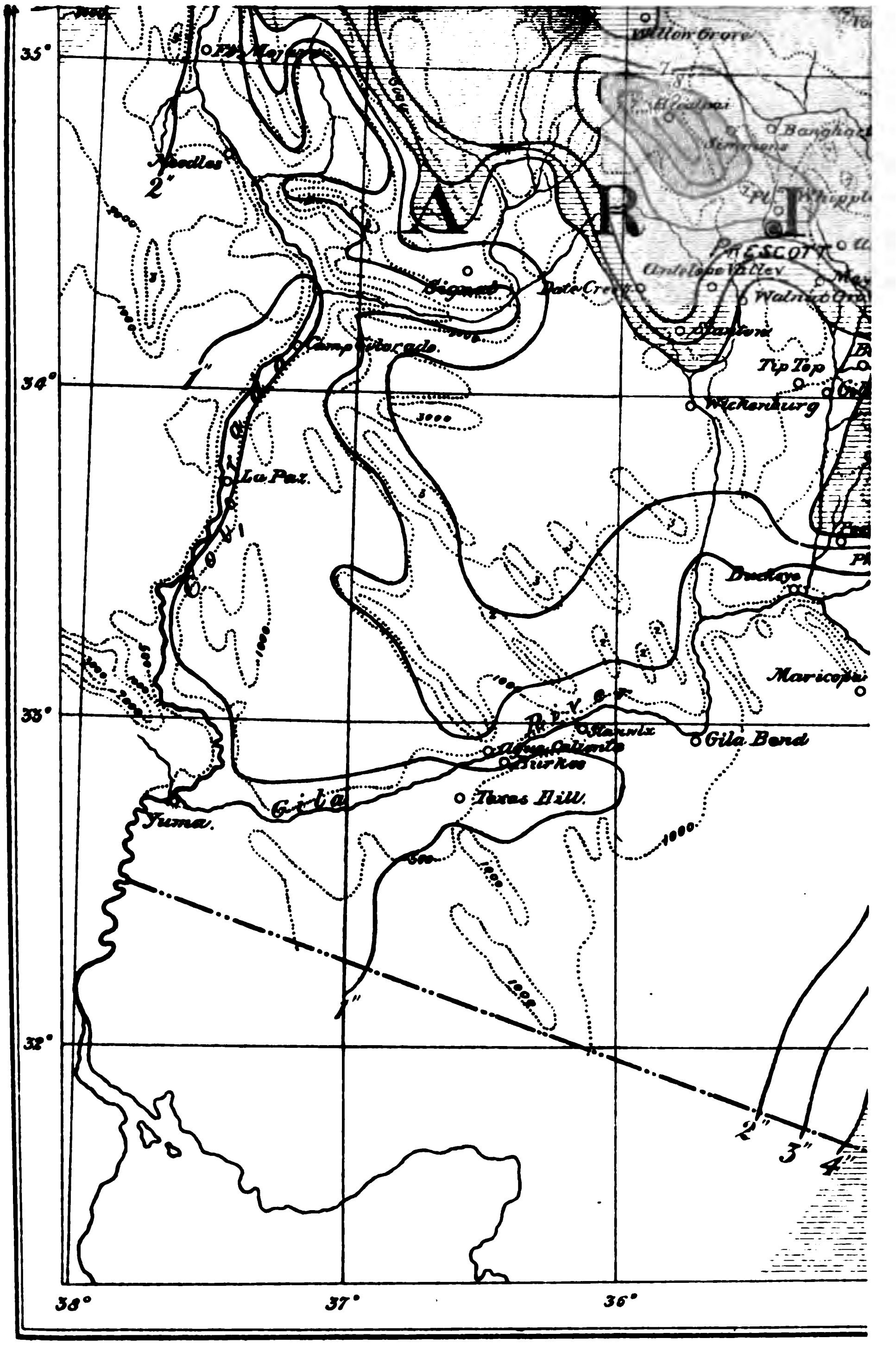35°
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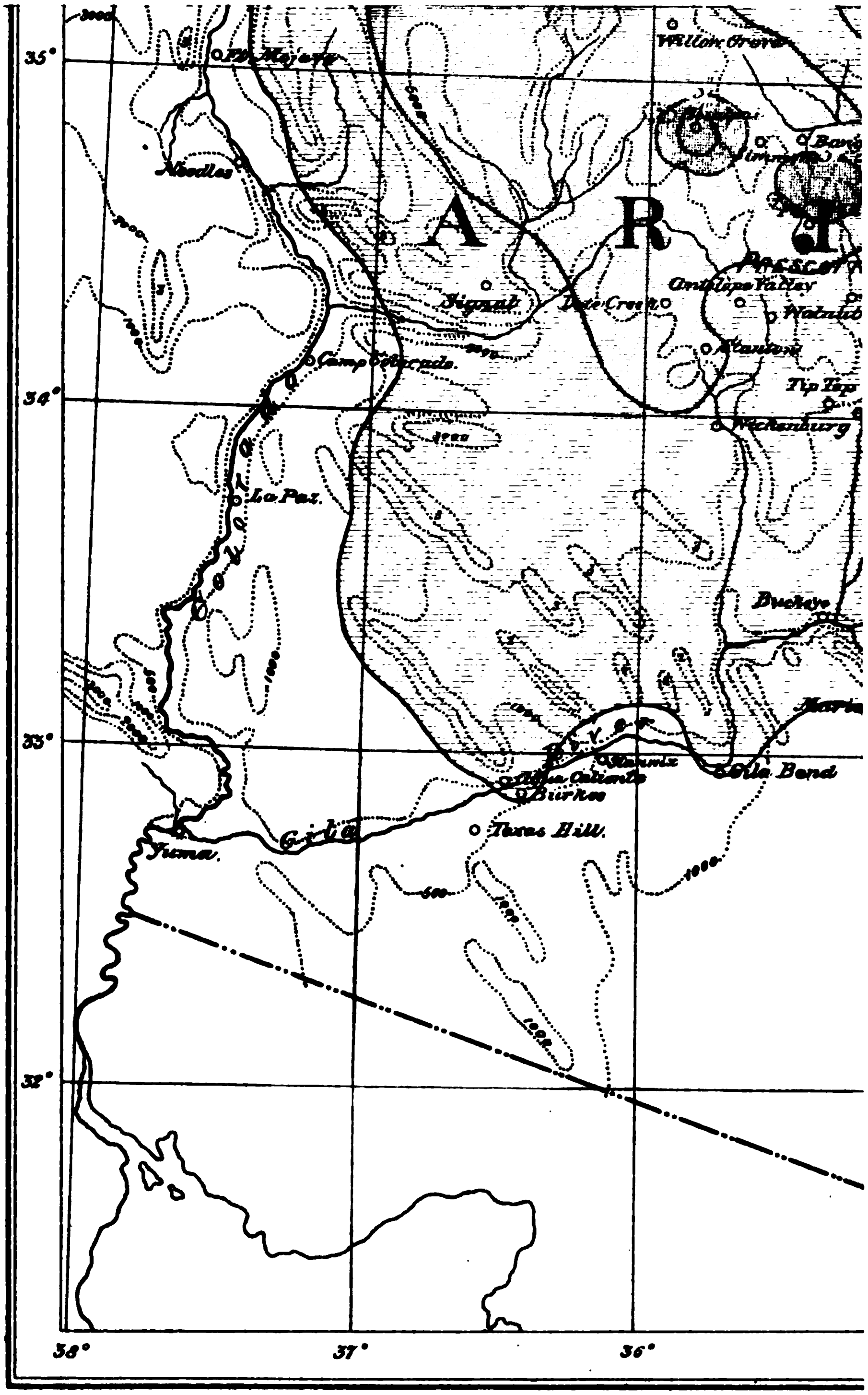
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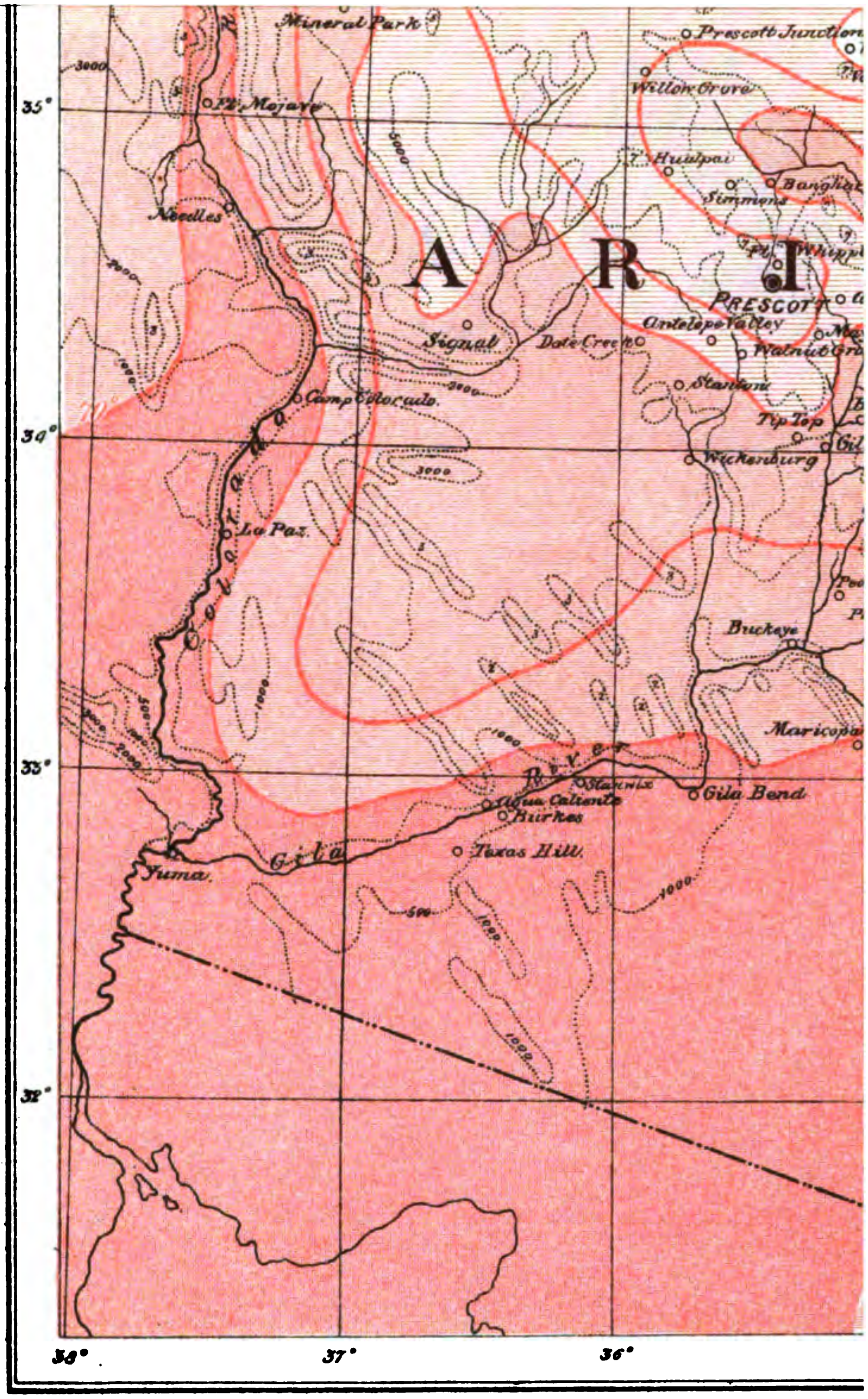
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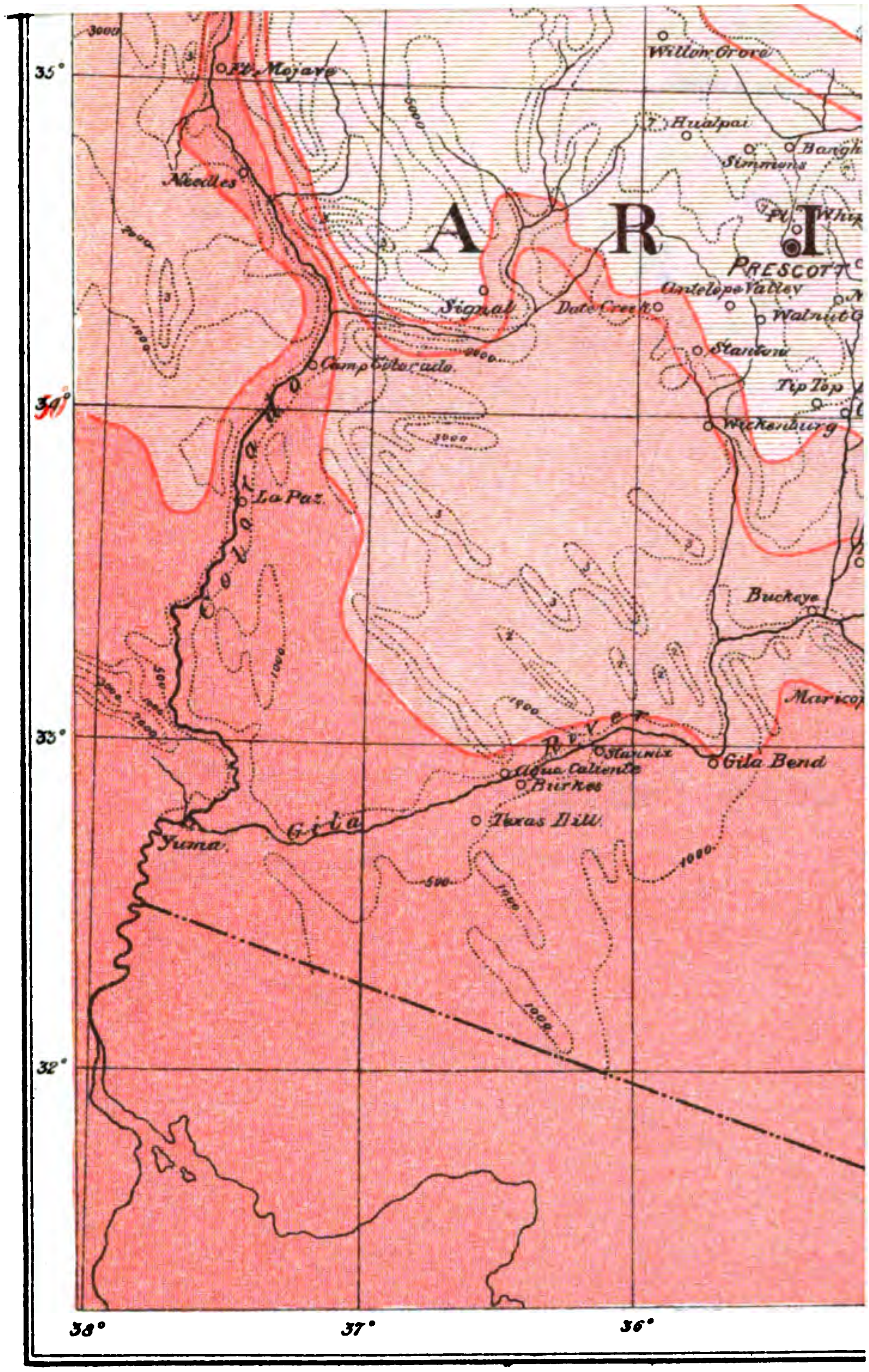
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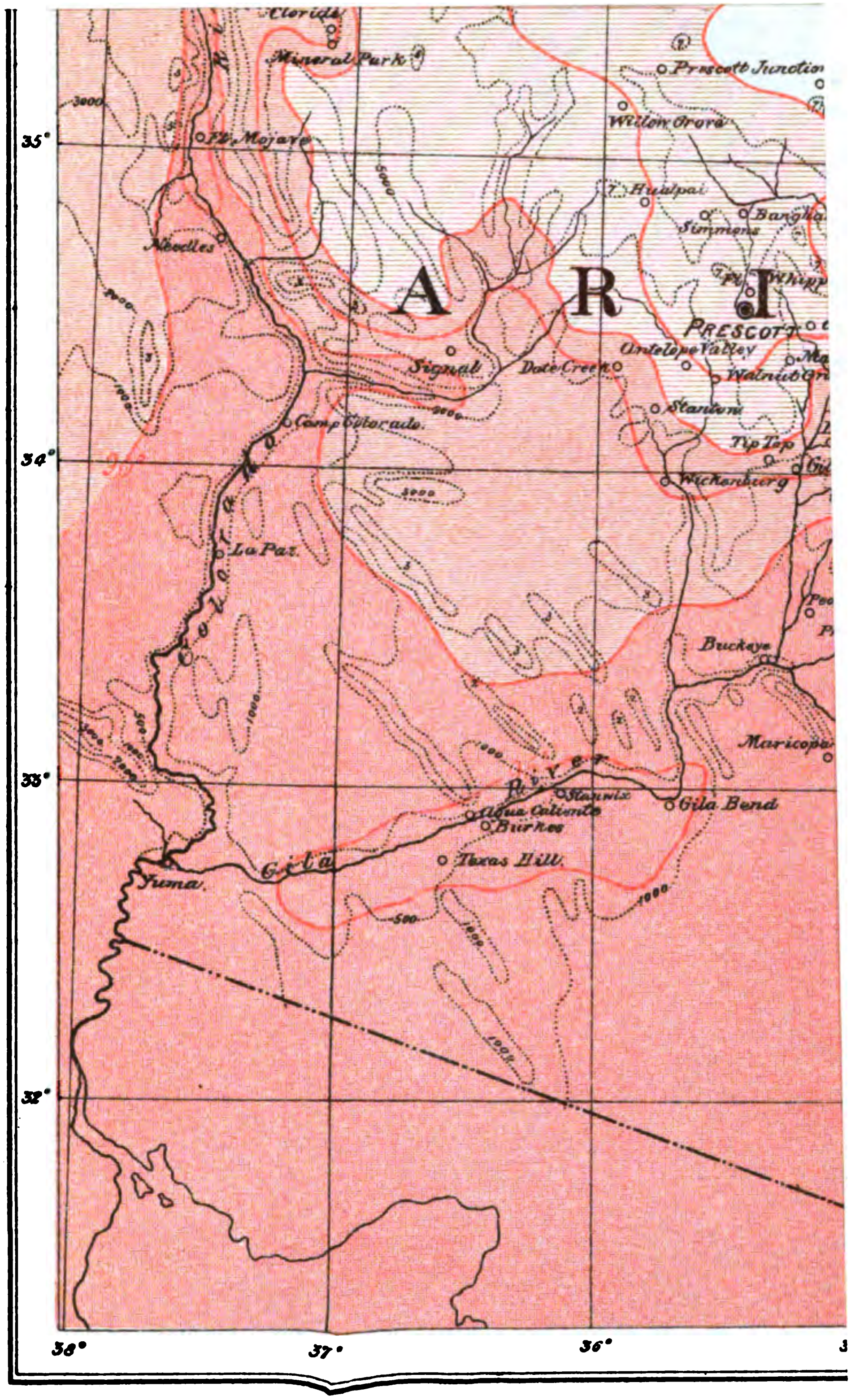
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